ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXI. No. 3396. DECEMBER 25, 1942 6d. WEEKLY

TECHNOLOGY DEPT.

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DETROIT

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Hearty Greetings

from **CROMPTON PARKINSON** Limited
AND ASSOCIATED COMPANIES

Since 1882 Fuel Economy has always been the aim and accomplishment of

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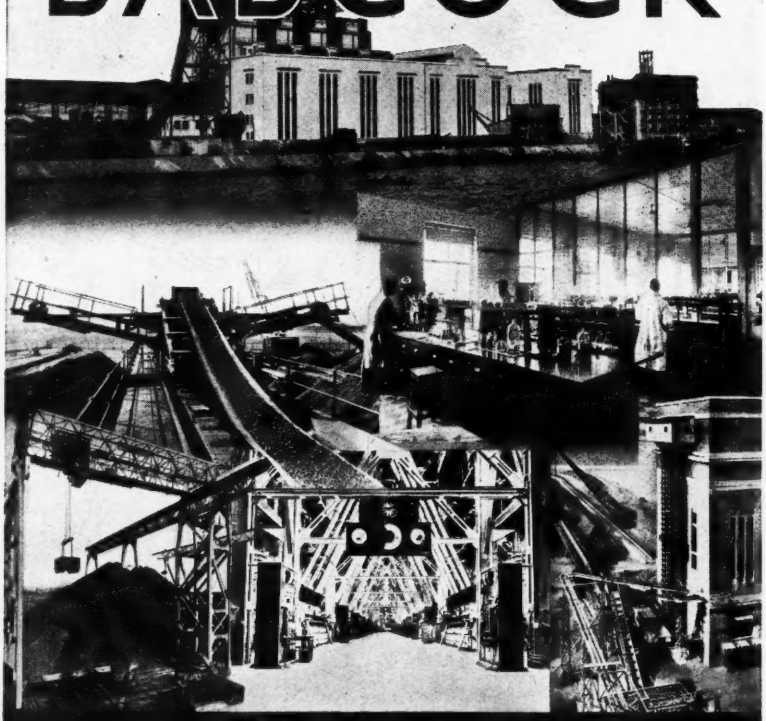

BABCOCK & WILCOX LTD. BABCOCK HOUSE, FARRINGDON ST. LONDON, E.C.4.

ALTHOUGH our service to many old customers is at present necessarily restricted, there is no limit to the good wishes we send to them at all times, and particularly at this Season.

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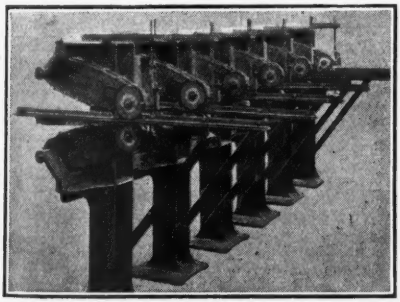
The WESTMINSTER ENG. CO. Ltd.
Victoria Road, Willesden Junction, N.W.10
Telephone : Willesden 1700-1 *Telegrams : "Regency, Phone, London"*



A batch of Pedestal Type single-ended "WESTMINSTER" PATENT
SCALING MACHINES
For removing the scale from 2 surfaces on one edge of plate simultaneously, preparatory to welding. The grinding wheels are self-adjusting for varying thickness

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SOUND TERMINAL WITHOUT SOLDER

Suitable for Telephone Lines
FOR CABLES AND WIRES OF ALL KINDS

SIZES FROM ⅛" to ¾" HOLE
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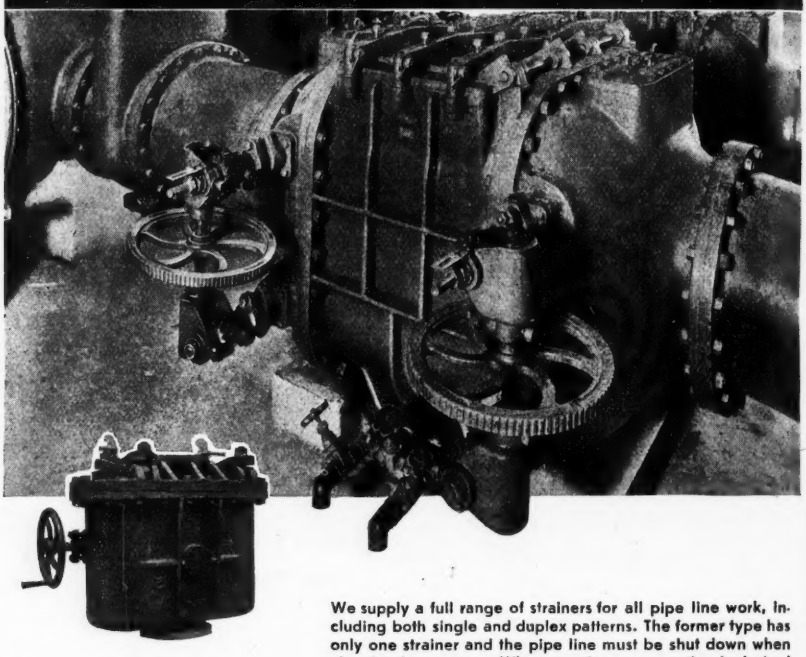
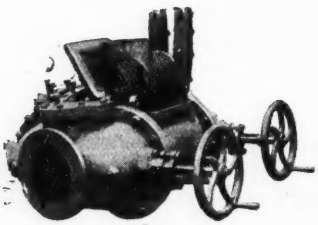
PIPE LINE STRAINERS





We supply a full range of strainers for all pipe line work, including both single and duplex patterns. The former type has only one strainer and the pipe line must be shut down when cleaning is necessary. Where continuous operation is desired the duplex patterns are recommended, in which each basket in turn can be isolated for cleaning while the other is in use. Both the duplex and single ranges have a design in which the headloss is kept at a minimum, and another in which a large strainer area is provided for slow filtration, as for oil feed water, etc.

The range of rises is extensive, running from 2" upwards in the cast iron patterns; below 2" there are series of bronze and forged steel single strainers, the latter in various strengths for working pressures up to 1,400 lbs. per sq. inch.

The main illustration shows 30 in. four-basket-type duplex strainers at a well-known plant, and the inserts smaller duplex strainers of straightway and "H" patterns.

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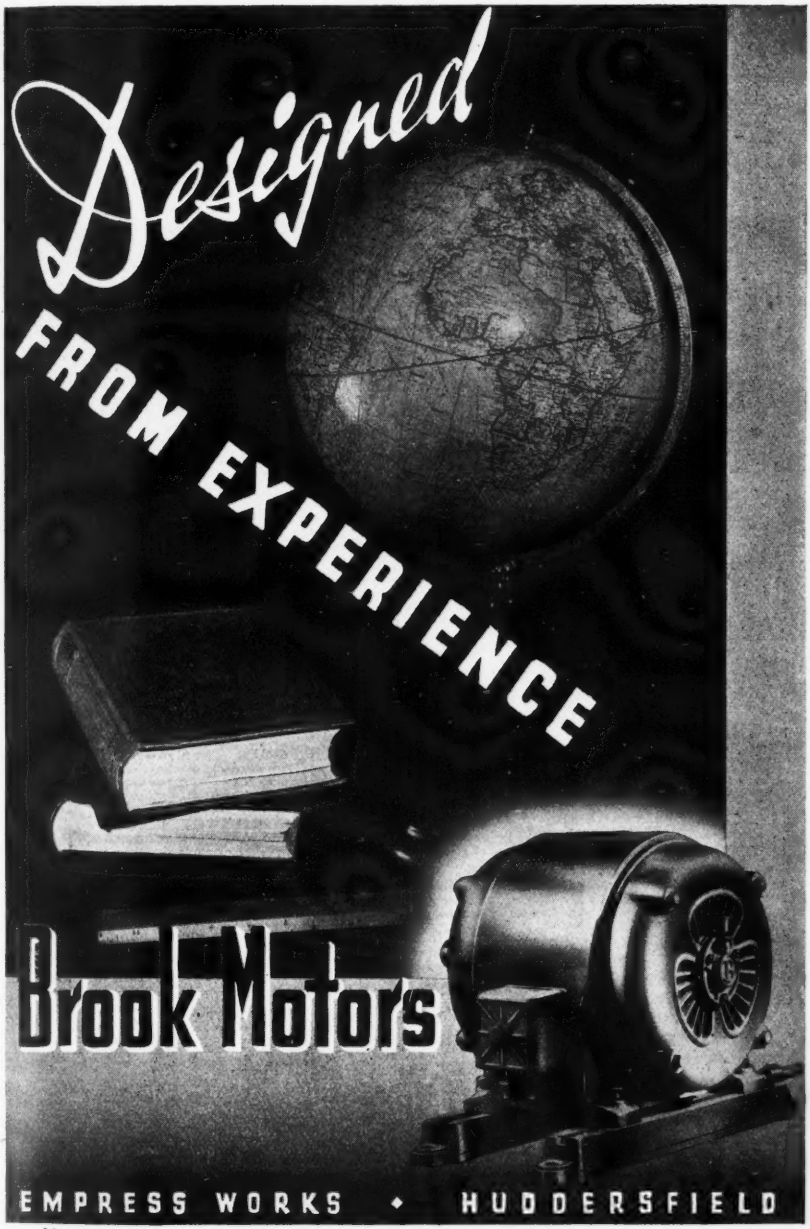
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FROM EXPERIENCE
Brook Motors
EMPRESS WORKS • HUDDERSFIELD
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5 ADVANTAGES of COMPO H

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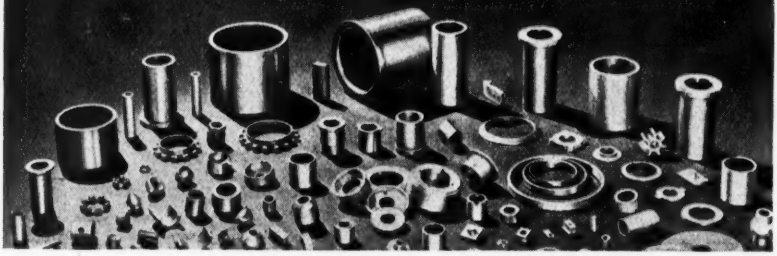

1 **SAVING IN MATERIAL.** Compo Bearings are die pressed to finished dimensions. No scrap metal from machining.

2 **SAVING IN TIME.** No machinery is necessary. Compo Bearings are finished with a mirror surface.

3 **SAVING IN MACHINE TOOLS.** The high quality finish of die pressed Bearings eliminates the use of lathes and equipment, releasing them for other work.

4 **SAVING IN INSTALLATION COSTS.** Our recommended low cost assembly methods save much of the installation costs of ordinary bearings.

5 **SAVING IN SERVICE COST.** The excellent wear characteristics of the metal composition of Compo Bearings ensures trouble-free operation and very long life.

Write for a copy of the "Compo H" brochure, which gives more detailed information of the composition and application of these bearings. If you have a problem concerning remote or inaccessible bearings our Service Department can probably help you.

Compo H Bearings are die pressed from true alloy bronze powders. The oil is impregnated into the bearing and the porous structure takes up to 30 per cent. by volume of lubricant. An oil film is maintained by capillary attraction and metal to metal contact is prevented.

COMPO H

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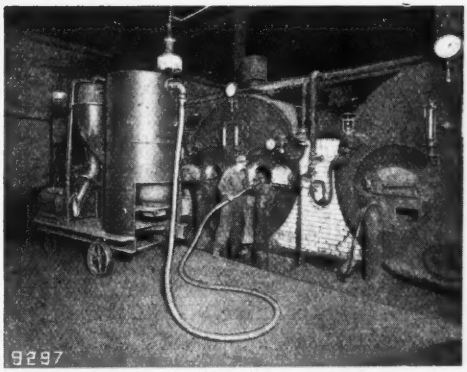

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You, too, although industrially situated more centrally, need the "extra" reliability and extra "power-hours" given by all L.D.C. Motors. They are designed and built by people who take a pride in their work, one of the many sound reasons for their proven reputation for RELIABILITY.

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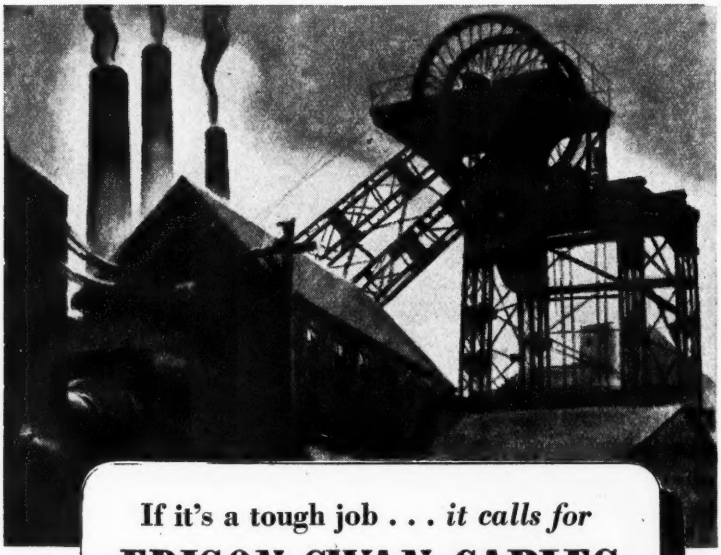

If it's a tough job . . . *it calls for*

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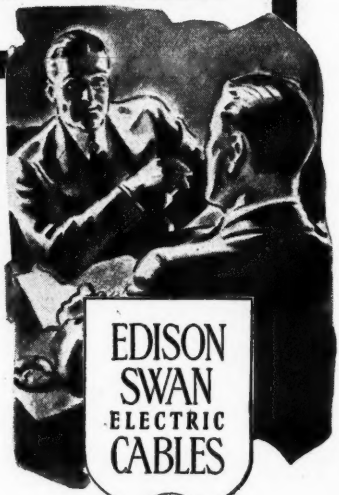

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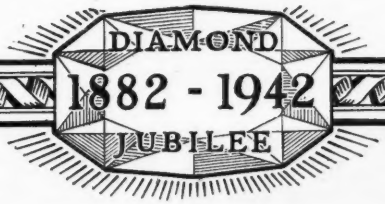

60 YEARS OF PROGRESS

THE evolution from the small London workshop of 1882 to the vast Ferranti plants of to-day is a story which synchronizes with the entire history of commercial electrical development.

The personal inspiration and inventive genius of Dr. Ferranti during the first forty-eight years of this period has created a tradition of restless progress which remains a vital urge to new electrical achievements in the service of the human race.

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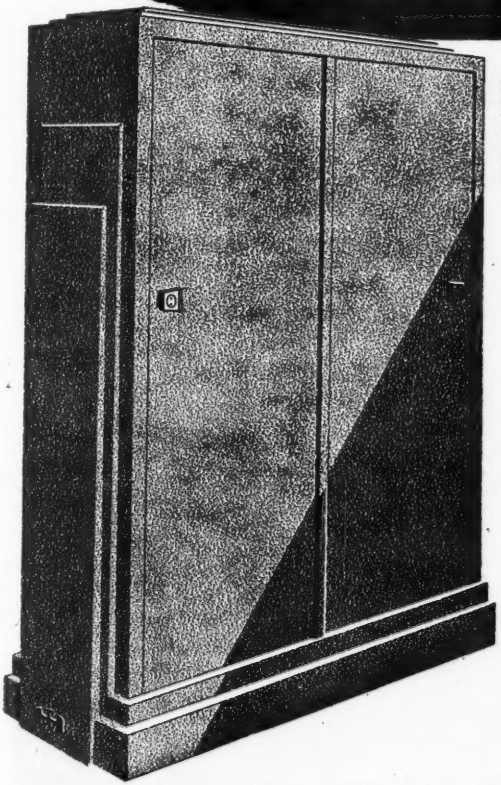

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AT 440 VOLTS 3-PHASE

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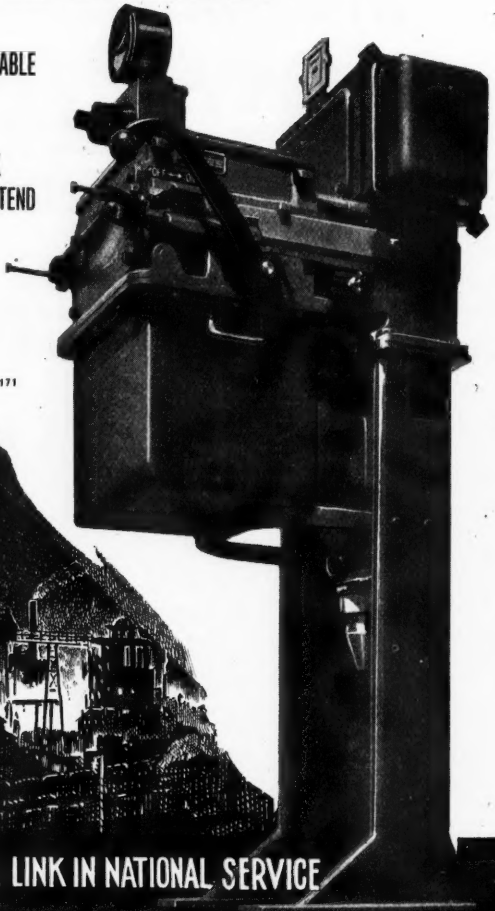

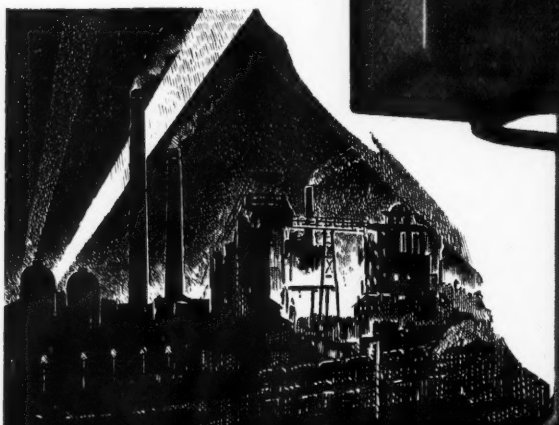

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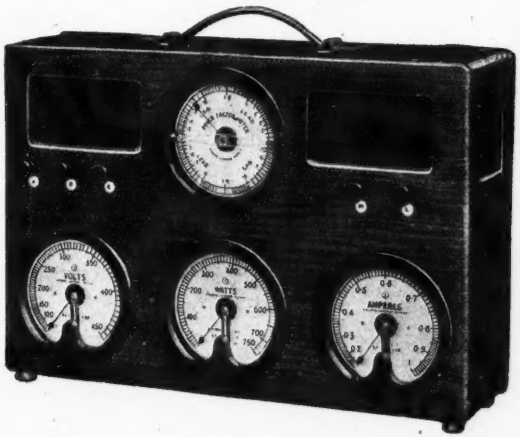
B.S. N C S FIRST GRADE



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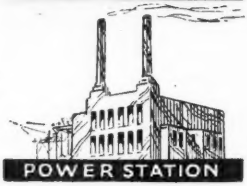

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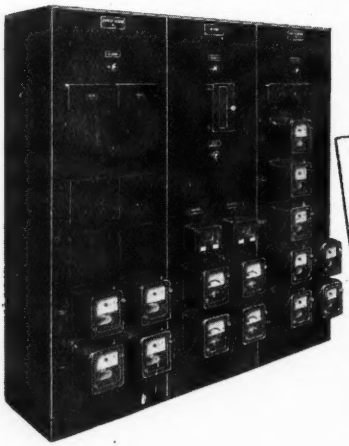

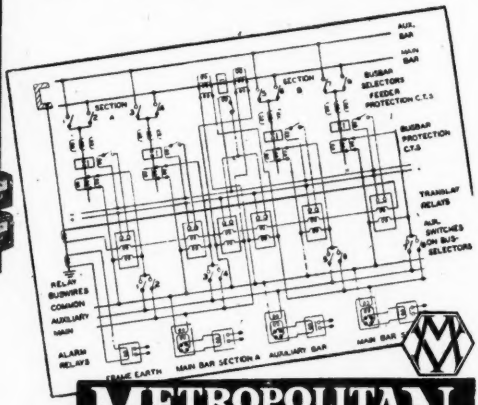

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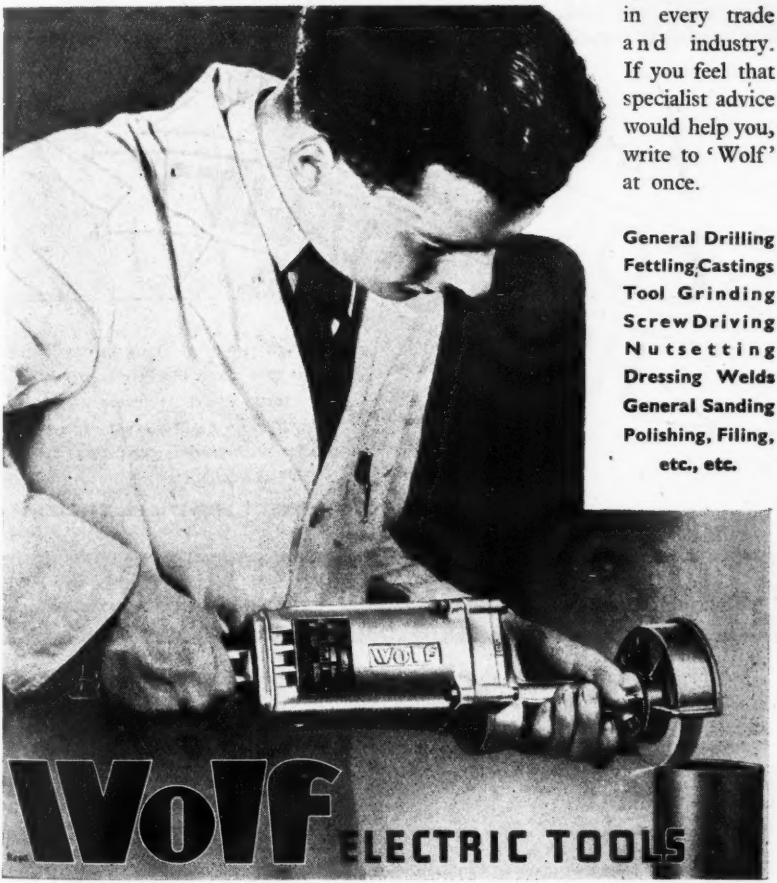

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From "COCK-A-DOODLE-DO" by Charles B. Cochran. (Reproduced by kind permission of the publishers, J. M. Dent & Sons Ltd.)

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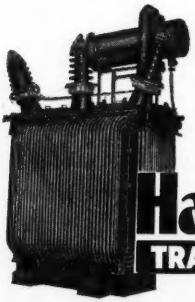

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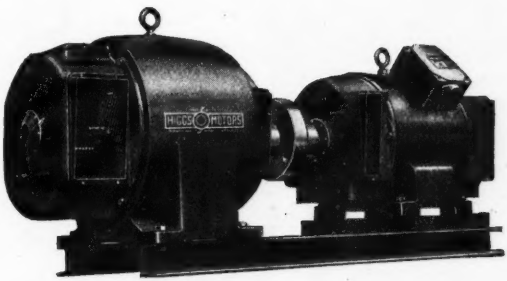

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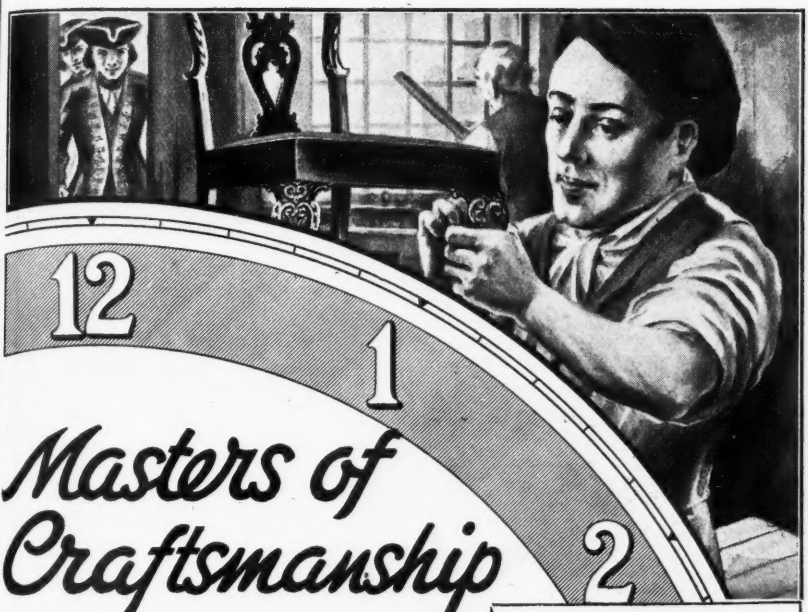

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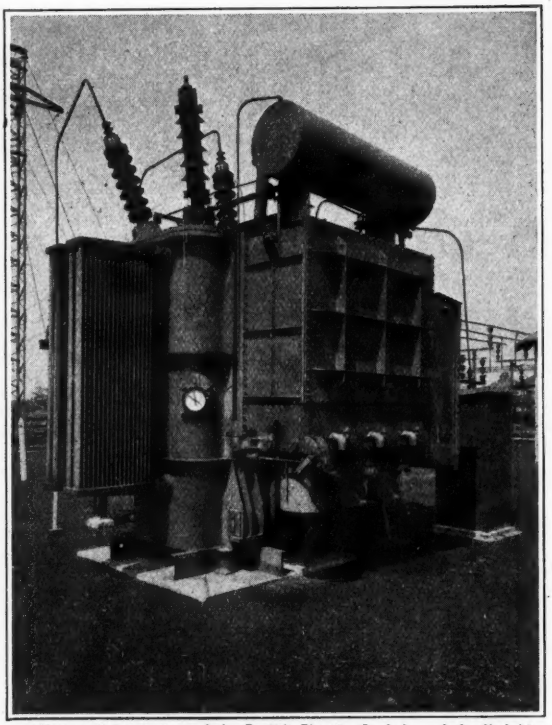

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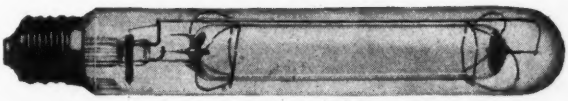

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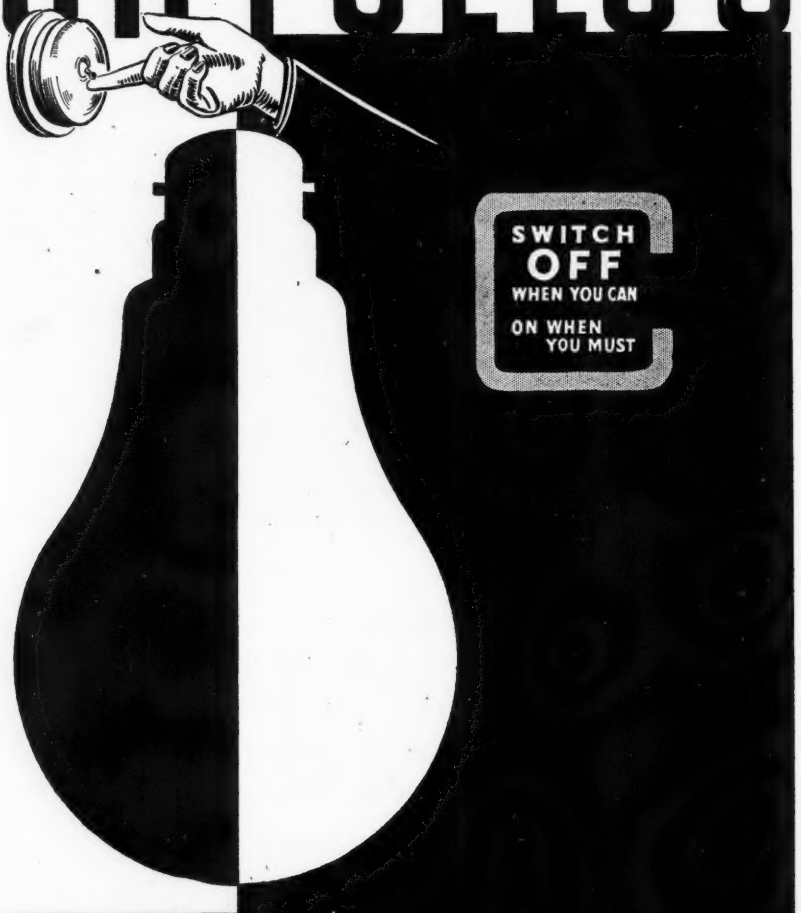

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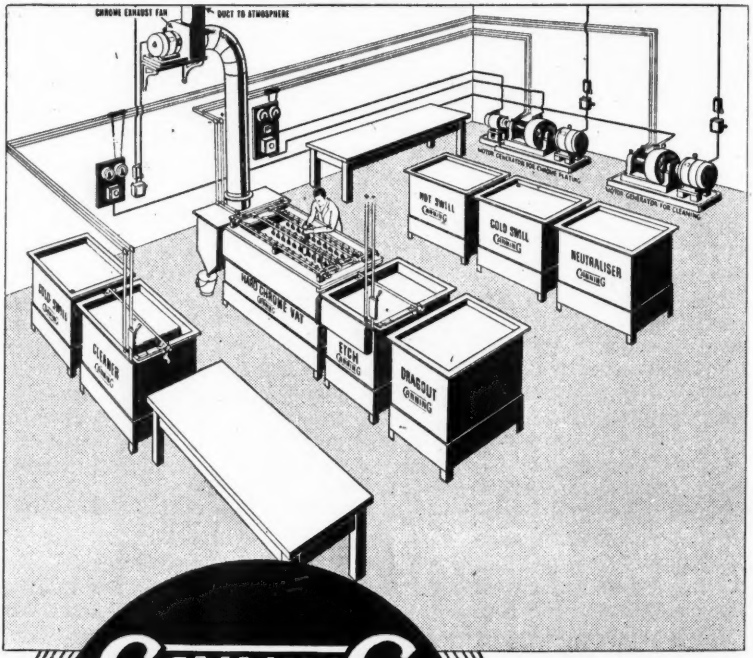

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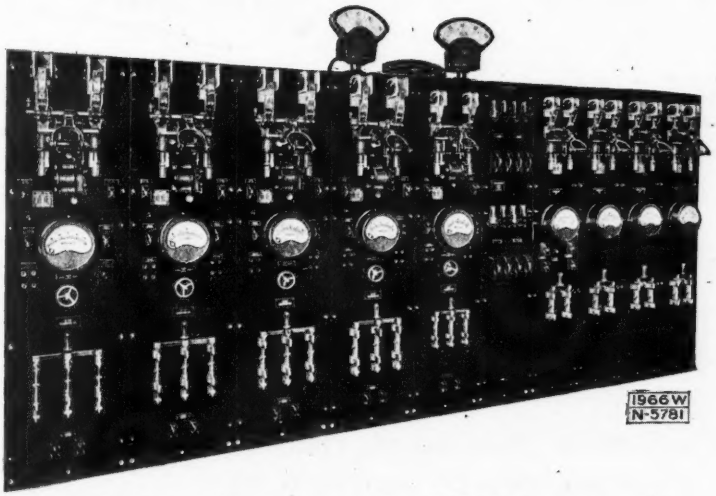

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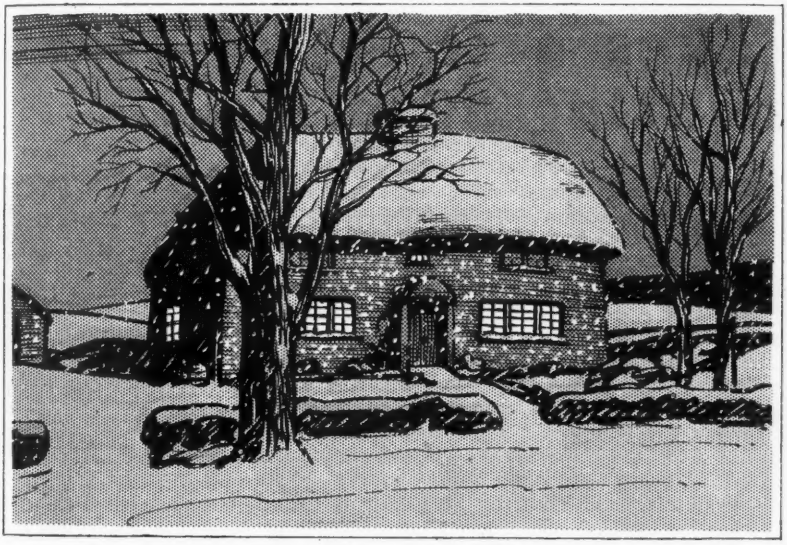

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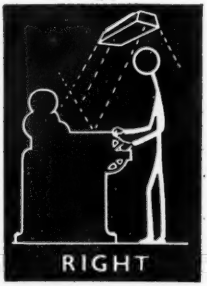

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ELECTRICAL REVIEW

Volume CXXXI — No. 3396

Friday, December 25, 1942

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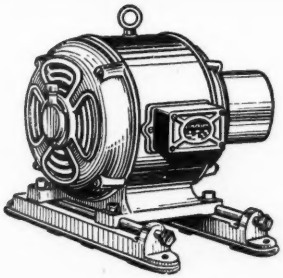

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Vol. CXXXI. No. 3396. DECEMBER 25, 1942 6d. WEEKLY

Highland Water Power

Clearing up an Unsatisfactory Position

THE record of hydro-electric development in Scotland is not a happy one. No new developments have been initiated in the northern parts, where most of the untapped resources are situated, during the last twenty years. For this the electricity supply industry is not responsible. To date 315,000 kW of hydro-electric generating plant has been installed in Scotland—a figure substantially in excess of the 218,000 kW estimated by the Water Power Resources Committee (1921) as the whole *potential* output there. More still would have been done by private enterprise had not the six schemes promoted since 1929 been rejected, for irrelevant reasons, by Parliament.

Grampian Company's Efforts

With regard to distribution, the Grampian Co. has had the technically difficult and financially thankless task of supplying stretches of sparsely populated area of Northern Scotland. Its efforts have now received well-merited commendation in the Report of the Committee on Hydro-Electric Development in Scotland (set up after the failure of the Glen Affric Bill last year) which is reviewed in this issue.

The Committee looks at the subject from two angles. The first relates to the generation of electricity, the second to the amelioration of social conditions in the Highlands. The great obstacle to Parliamentary sanction has been, it is stated, the subordination of major issues to sectional interests. Yet water power stands out as a potential source of considerable wealth to the Highlands—not by enabling electricity to be retailed to crofters at uneconomic prices, but by wholesale export to the ready market of the British grid and by attracting industries to the spot, thus providing local employment.

The last-named offers most promise, since with adequate storage high plant load factors would obtain, and it is technically the best plan to bring processes with high load-factors to the power station sites, electro-chemical and electro-metallurgical processes being especially suitable. Many of these could not otherwise be carried out.

One objection, often sincere, to this course is a feared injury to amenities. Most of the projected schemes are, however, in the most inaccessible parts of Scotland which are visited by few. Moreover, cases can be cited in which existing plants have actually improved aesthetic values. In any event, there is surely something to be learned from war experience in the concealment of buildings.

Communications and Labour

If, as appears, most of the projected schemes are in the most inaccessible parts of Scotland, we feel that the proposal to locate industry on those sites will mean a very heavy expenditure in opening up communications to them. There is also the problem of importing and accommodating the necessary labour.

It would be a good thing if, as a result of the daylight which the Report lets into a controversial subject, the two projects referred to by Prof. Fortescue in his

I.E.E. presidential address will be put in hand as soon as circumstances permit.

In seventy schemes included in the Committee's provisional estimate the average capacity is only about 6,500 kW, and it is to be doubted whether they would prove as economical as the larger steam stations otherwise required. In view of this and of the length of time required to construct the water-power stations, their ownership would presumably be unattractive to power companies. The proposed formation of a North Scotland Hydro-Electric Board seems therefore the best course, provided it is allowed full discretionary powers to carry out its functions unhampered by external political interests.

The Coal Position

It is gratifying to those who have opposed electricity rationing on the grounds of impracticability to find that voluntary methods are being justified. In the House of Commons last week, Major Lloyd George said that he was " not dissatisfied " with the progress that had been made. Assuming that there was no major catastrophe and the economies continued, there would be enough coal to see us through this winter. He warned the country, however, that the position beyond that was obscure.

Benevolence

SEASONABLY enough comes a reminder by the President of the Institution of Electrical Engineers, Professor C. L. Fortescue, of the claims of the Benevolent Fund. It is good to learn of the considerable growth in the number of subscribers as compared with a few years ago. Members are reminded that while it is convenient to pay subscriptions by a bankers' order, a deed of covenant for a period of seven years is just as convenient and, in effect, subscriptions are doubled by the adoption of this method.

Motor Overloads

IN discussing the present need to make the utmost use of copper, the *General Electric Review* refers to 15 per cent. as the overload that could be carried continuously by a motor rated for a 40 deg. C. rise at full load. A consequent increase of 10 deg. might reduce the life of the insulation to ten to fifteen years instead of the usual twenty to thirty years. For war purposes five years, allowing 25 per cent. continuous overload, might be considered for low ambient temperatures. In view of variations between the hottest-spot temperatures of different machines it seems to us likely that the last proposal would leave too fine a margin for reliability in all cases.

No Economy Change-overs

THE Electricity Commissioners requested supply undertakings some time ago to provide new supplies, or extend existing facilities, only where these were required for essential war purposes or where the withholding of them would cause serious hardship. It has been suggested to the Commissioners that the need for fuel economy has introduced a new factor and that changes from present methods to electrical ones are justifiable as a means of saving coal and oil. In the Commissioners' opinion, however, this consideration is overborne by the demand of industry for all the electricity available and they cannot sanction such changes.

Heating Appliances

IN announcing this decision the Commissioners refer to the continued availability of electric heating appliances in all kinds of shops. Representations have been made to them on several occasions recently, as these appliances are not conducive to economy and add to the supply undertakings' peaks. The Commissioners say that they cannot have the equipment banned, but point out that the recent restrictions on manufacture will eventually have the desired effect.

" Reviews " for the Forces

OUR recent appeal to readers to pass on their copies of the *Electrical Review* to War Comforts Committees has met with an excellent response and we have been able to arrange a number of contacts. On behalf of the Committees to whom the copies are being sent we express thanks to those sending them and remind others that the demand still exceeds the supply.

The Season's Greetings

IN extending our best wishes to readers at home and overseas on the occasion of the fourth wartime Christmas we may express the hope that next year will see the end of the war. There is at least more ground for optimism than there was a year ago.

Large Hospital Installation

Up-to-date Distribution Methods at the New St. Helier Hospital of the Surrey County Council

AN excellent idea of modern installation and distribution practice as applied to large blocks of buildings grouped together is to be gathered from a visit to the new St. Helier Hospital which the Surrey County Council is just completing at Carshalton.

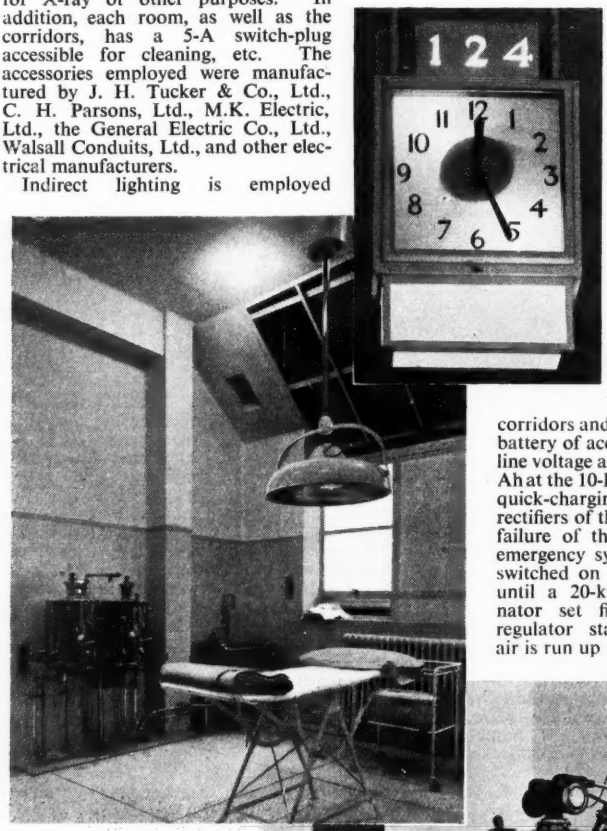
Commenced in 1937, this hospital is designed for 862 beds, but the accommodation can be increased if necessary. It comprises a central building which contains the six-storey main wards on the south, and the administration department with living accommodation for the medical staff, chapel and operating theatres on the north centre. The hospital kitchens with maids' home above and the out-patients' department which embraces the various clinics, including the X-ray and radiological and electrical treatment departments, are on either side. Around this central building and connected to it by corridors and passenger subways are grouped the special unit with pathological department and "central station," the maternity, chest and children's units and the nurses' home (with self-contained kitchen); also the isolation block which is not served by a passenger subway. A subway carrying all the services connects the various buildings.

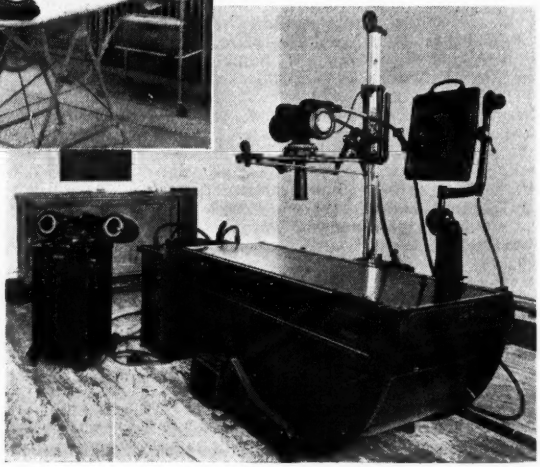
A 400-V, three-phase, 50-cycle, four-wire supply from the London and Home Counties Joint Electricity Authority is received at a substation located in the hospital through two 1-sq. in. feeders, a summation metering panel being provided. The main control consists of two feeder panels and nine distribution panels, the switchgear being Crompton Parkinson "Klad A" type having a rupturing capacity of 25,000 kVA and fitted with overload and earth-leakage trips and kWh meters, and the usual indicating instruments. The customary trip battery and charging arrangements, together with a trip alarm arrangement indicating in the engine room, is also provided. Owing to the confined space available the main control switchgear has an extended busbar connection from the switches to the floor space in specially arranged trunks. The cables carried in this floor space are connected *via* heel-type boxes.

For all the services p.i., l.c., s.w.a.s. cables are carried through the service subways to the sub-main control switchgear for lighting, auxiliary heating, cooking and power, and to the control and connector boards for the other services. Three 0·3-sq. in. ring mains with one short 0·4-sq. in feeder for the central station cater for lighting, auxiliary heating, cooking and power. Each block has a composite main control unit having air-break switchgear, meter and distribution fuseways with removable links on the busbar and arrangements which enable temporary connections to be made when necessary between the control units. From the distribution fuseways p.i., l.c., s.w.a. rising mains are taken to flush-mounted ironclad fuseboards. The switchgear and control and connector boards and flush fuseboards were manufactured by the Kartret Switchgear Co., Ltd., and the wiring was carried out in Walsall conduits with Enfield cables. For the lighting, ceiling rose looping saves material and simplifies fault location.

In the wards there is a 15-A switch-plug for medical or domestic purposes between each pair of beds, while there is a 30-A switch-plug within 100 ft. of each of the beds for X-ray or other purposes. In addition, each room, as well as the corridors, has a 5-A switch-plug accessible for cleaning, etc. The accessories employed were manufactured by J. H. Tucker & Co., Ltd., C. H. Parsons, Ltd., M.K. Electric, Ltd., the General Electric Co., Ltd., Walsall Conduits, Ltd., and other electrical manufacturers.

Indirect lighting is employed throughout the wards and some of the specially designed brackets utilised are arranged for additional dim lights. With the exception of the ward brackets, combination staff locator, clock and lighting units, the entrance hall and main staircase and chapel fittings, which were manufactured by Hume Atkins & Co., Ltd., and the Troughton & Young units installed in the principal rooms in the nurses' home, the lighting fittings are of conventional design supplied by the above-named firms, together with Frederick Thomas & Co., Ltd., and Best & Lloyd, Ltd. "Scialytic" universally adjustable shadowless lamps (Technical Lights, Ltd.) over the operating tables in the three operating theatres and first-aid rooms are connected with a Chloride "Keepalite" emergency lighting system which also serves corridors and staircases. For this a battery of accumulators working at line voltage and of a capacity of 120 Ah at the 10-hr. rate is installed, with quick-charging and trickle-charging rectifiers of the bulb type. On the failure of the normal supply this emergency system is automatically switched on and sustains the load until a 20-kW single-phase alternator set fitted with a voltage regulator started by compressed air is run up to take the load. The





One of the special universally adjustable "Scialytic" lights installed in an operating theatre, and (above) a staff location call sign combined with an electric clock. Right: The main X-ray equipment

generator set, which is Diesel-engine driven, is of the radiator water-cooled type.

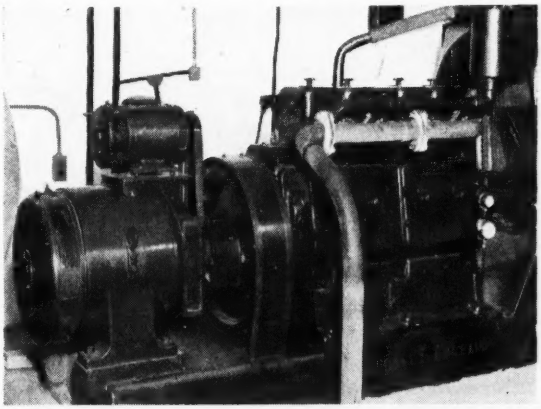
In order to avoid any risk of explosions in the anæsthetic-laden air the switches in the operating theatres are of the mercury type (Walsall), and earthing plugs are provided to dispose of static charges. This risk is further minimised by the provision of special ventilation and air-filtering systems incorporating an air washer (2½-HP motor) and an inlet fan (4-HP motor) on the roof and two extract fans (1-HP motors) situated under the operating theatre. The motor starters and speed regulators are interlocked so that the variable-speed motors (500–700 RPM) of the extract fans cannot be started until the inlet fan is running and the same proportion of speed regulation is maintained over the whole range.

The electrical diagnosis and treatment section of the hospital is not yet completely equipped, but the X-ray equipment so far installed consists of a Victor " KX8/33 " unit, the transformer of which is readily controllable up to its maximum output of 500 MA at 85 kV. This equipment makes it possible to carry out over-table radiography and under-couch screening, while the table can be traversed through 90 deg. for vertical screening. The over-couch tube is of the rotating anode type.

The installation was carried out by the Victor X-Ray Corporation under the supervision of the Ministry of Works and Planning. The automatic circuit-breaker employing rectified AC for silent operation, is push-button operated. The dark room is equipped with special developing lamps and film drying apparatus incorporating electric fans. Portable X-ray apparatus fed from 30-A plugs is used throughout the hospital.

The diathermy department is completely screened with ¼-in.-mesh metal screening material and the windows are fitted with metal mesh roller blinds. The lighting units are also screened so that all the wiring and lamps for lighting are outside the screen, while the wiring for power and the diathermy apparatus itself is inside, the service to the power wiring being filtered through a Belling & Lee interference suppressor. The screening is earthed to prevent interference with radio reception. The cardiography, deep and superficial therapy, ultra-violet and infra-red ray and electric baths departments are not yet equipped. All the electrical treatment rooms have systems of extract ventilation, the air entering through grilles which incorporate air heaters. A similar ventilating system serving all the 'sterilising rooms is arranged to come into operation on the closing of a switch in any of them.

In the wards each patient is provided with a push-button connected with the nurse call system (Julius Sax). This includes luminous indicators fixed outside the wards and bells in the ward offices, a special flicker device being provided for the maternity unit. Resetting of the indicators can only be done inside the wards. DC at 12 V supplied through trickle-charged " Nife " cells with Westinghouse truck-type metal rectifier units is used for the call system. Except in certain wards where loudspeakers are employed, radio is available at each bed through Brown hospital type headphones. The receiver and amplifier unit (F. W. Smurthwaite, Ltd.) is fitted with a time switch and also a microphone which enables patients to receive messages broadcast through the hospital. Test sockets with cut-off switches are provided outside the wards.



The 20-kW AC generator set used for emergency lighting

A staff location system permits the calling of any of thirty-nine persons by means of the combination of the three numerals " 1," " 2 " and " 4 " which have been chosen for their distinctive appearance. In most cases the illuminated call signs are combined as a single unit with the " Magneta " electric clocks. The locator system works through a Klaxon selector and impulser, the impulses operating " Sordoviso " relays which in turn actuate secondary circuits at line voltage to illuminate the numerals.

In addition to the G.P.O. telephones there is an Ericsson domestic automatic telephone

system with conference calling arrangements, certain instruments also being fitted with fire-alarm presses. The Chloride battery employed for the ringing also operates the clocks and the relays of the staff locator system.

Each main unit is provided with a pair of 15 cwt. bed-passenger 120-ft.-per-min. lifts, the nurses' home having 9-cwt. lifts running at 120 ft. per min. The usual safety features are provided, together with emergency releases for the doors. So that adjustments can be carried out the more readily each car is fitted with telephone jack and lines to the motor rooms and a cut-off switch in the lock circuit on the top of the car enables the lift to be stopped during inspection of the shaft. Goods lifts are also provided. All the lifts are of the " vernier cushion control " type, made by Hammond & Champness, Ltd., and are fitted with Belling & Lee radio interference suppressors.

The Boiler House

Five coal-fired boilers, each rated at 8,750 lb. per hr. from and at 212 deg. F., fitted with Keith Blackman induced-draught fans (11-HP variable speed motor), automatic stokers and Radiovisor smoke detectors, provide steam for heating the building, cooking, hot water and sterilising. The high-pressure steam is fed into steam turbines working against a back-pressure of about 5 lb. per sq. in., the low-pressure steam being then fed into a calorifier, and the heat transmitted to the water, which is pumped round the building. For the pumping either steam or electrically operated pumps may be used, 20-HP, 1,450-RPM motors being employed for the cold water pumps and 2-HP, 925-RPM units for the hot water. The associated starters (mostly Brookhirst) have a number of automatic features. Four condensate and drainage pumps are driven by 1½-HP, 1,400-RPM units. Coal is supplied to the boilers by means of a conveyor (two 5-HP, 960-RPM motors), and the ash is removed by a hoist (3-HP motor). A remote temperature indicator shows at a glance the temperature at twelve points throughout the building, facilities being provided to record the temperature at six points. All the motors employed for the above equipment are of Bull manufacture.

The large quantity of water required in the building is furnished by a 7,000 gal.-per-hr. deep well electric submersible pump (Hayward-Tyler), located 300 ft. below the ground level. This is operated by a 22-HP motor automatically controlled by a float switch. A fire pump (Pullen) delivering 350 gallons of water a minute at an added head of 300 ft. is automatically put into operation as soon as the water pressure is released. Its motor is a 40-HP, 1,440-RPM Bull unit.

Although, as already mentioned, steam is used for cooking purposes, the kitchens are equipped to use both electricity and gas, it being considered desirable to have as many alternative methods of cooking as possible in case of emergency. The kitchens are arranged with the main kitchen in the centre and the diet, staff and pastry kitchens at the sides. Apart from such items as a Peerless mixer, " Hallmark " ice cream machine, etc., all the cooking apparatus was provided by Benham & Sons, Ltd., the electrical equipment comprising a three-unit elevated range, roasting and pastry ovens, a two-pan fish fryer and a small grill. For ventilation, cool air is brought in at a low level and extracted by means of a Matthews & Yates fan in the roof.

The cold rooms in the kitchen are served by a J. & E. Hall ammonia refrigerator (12½-HP, 940-RPM Bull motor) through a brine circulation system, the brine pump being driven by a 2-HP, 1,430-RPM unit. Another small refrigerator (½-HP, 1,430-RPM motor) employing methyl chloride as the refrigerant, is used for laboratory purposes and for the mortuary.

Meals prepared in the main kitchens are placed in " Hot Lock " electrically heated trolleys (or will be when they are delivered) which are plugged into wall sockets, of which thirty are provided, to await dispatch by service lift to the wards. On arrival there they are immediately plugged in again at points in the ward kitchens so that there is little chance of the food getting cold. Each ward kitchen is also equipped with its own small cooker and B.T.H. refrigerator.

The architects were Saxon, Snell & Phillips. The electrical installation, designed by Couzens & Brown, was carried out by T. Clarke & Co., Ltd., under the supervision of the electrical and mechanical clerk of works, Mr. L. Sellick, the resident engineer of the hospital. The consulting engineers for the boiler plant and heating and ventilating work were J. Roger Preston & Partners.

Battery Separators

THIN pliable sheets of wood used as separators between the positive and negative plates of lead-acid accumulators must be permeable to permit ionic exchange within the electrolyte, free from volatile acids, contain little tannin and resinous matter, resist chemical action and be of reasonable mechanical strength. The most commonly used timber has been the American *Chameocyparis lawsoniana*, or the Port Orford cedar. The Indian Forest Research Institute has been investigating the subject, some of the tests being described in a leaflet (No. 14) of the Utilisation Section, Forest Research Institute, Dehra Dun, which shows that the following woods are suitable: *Adina cordifolia* (haldu), *Cupressus torulosa* (cypress), *Michelia champaca* (champ or champak) and *Talauma phellocarpa*.

Protection from Fire

Securing the Safety of Apparatus

By G. V. Harrap, A.M.I.E.E.

THE problems of protecting equipment from fire, always with us in peace-time, have been greatly accentuated by air-raids. Some of these were dealt with in an earlier article,* and the following notes are in amplification of previous information which has a bearing on normal conditions in many cases.

Where inflammable contents of a sub-station building come near the roof, the lining of the latter with a fire-resistant material is worth consideration. This will always be valuable should a switch fail to clear a fault and cause a fire. Equipment containing oil should have dwarf brick walls built round it, a long switchboard being subdivided so that oil from one switch cannot spread under others. The walls must be high enough to hold all the oil that can be released and must be far enough away from the apparatus to ensure that oil pouring out of a split seam in a tank does not fall outside the containing wall.

Following on this is the need to seal all cable holes in the building structure, especially in switchgear and other galleries. The cable trenches should be filled with good washed sand, and a light covering of cement floated over. Lead-covered cables inside the building

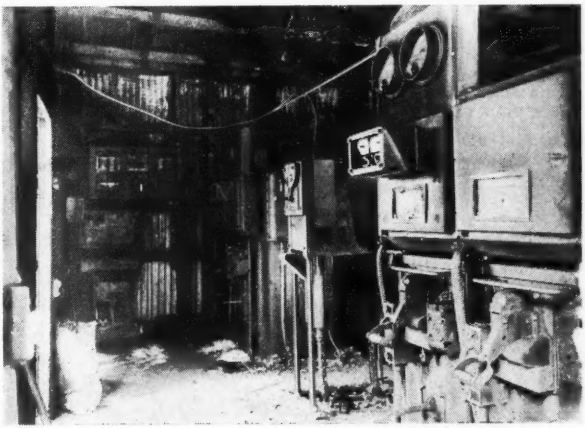


Fig. 1.—Interior of damaged substation; glass containers and hardwood cases of tripping batteries intact

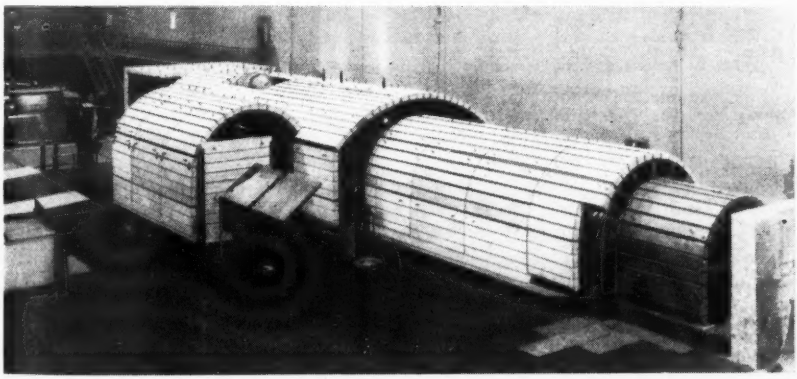


Fig. 2.—Steam turbine shrouded for protection against bomb splinters

* *Electrical Review*, November 13th, 1942.

should be stripped of their covering and wrapped with fire-resistant tape. Open transformer chambers should have a blast wall built in front of them, with a roofing between the wall and the building to stop entry of incendiary bombs into the chamber. Consideration should be given to the bricking up of windows, thus eliminating possible places for the entry of incendiary bombs. Some pitched roofs have awkward valleys that are a constant anxiety to fire guards. These should be filled with sand, and kept free from paper, straw, etc. Small timber roofs can sometimes be replaced by concrete constructions.

Switchgear and transformers in all important substations should always be segregated by fireproof barriers. A 9-in. brick wall has been found to be quite effective. In one case within my experience, an open transformer chamber was fronted by 1,000 tons of coke retained in position by wooden railway sleepers. This combustible material was set on fire in a raid, and slid into one section of the substation, setting fire to the transformers, which were entirely burnt out, causing their high-voltage switches to trip. There was a brick wall between the transformer and switchgear chambers, with one or two air bricks in it. Although the switchgear was of the sheet-metal cubicle type, and all insulators became coated in soot, yet the gear remained in commission at 6·6 kV, feeding another important substation. In another instance, the open transformer chamber was filled with burning cellulose enamel and paint. The transformers were again destroyed, but a 4½-in. brick wall was sufficient to save the switchgear. The chamber housing the latter got very hot, the rubber from v.i.r. cables on the ceiling dripping on to the switches. The brickwork was fused, but it served its purpose.

Switchgear, transformers and other equipment covered only by a light roof, such as corrugated iron, may be further protected by a covering of fire-resistant blocks, such as were originally developed for building light walls inside property, or by special sheet-steel constructions.

Glass containers for the cells of tripping batteries and their hardwood cases have been proved to be highly resistant to fire, but reliance should not be placed solely upon the materials of their construction. A simple case of asbestos slate can be a useful protection.

For rotary convertors, motor convertors and motor generators, a screen over the top is the minimum essential fire protection. This can well be of steel, although an angle-iron framework supporting 1¼-in. blocks of fire-resistant material is sometimes quite good, but unfortunately, most of it disintegrates if water falls upon it.

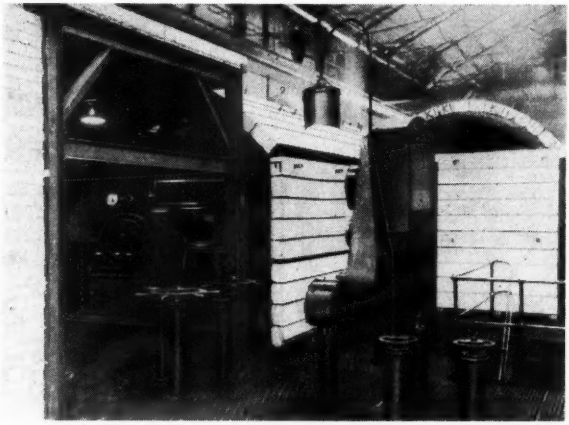


Fig. 3.—Protection of turbine controls at high-pressure end

Any glass in the roof of the building above such machines, should be removed or else a close-mesh screen should be fixed underneath. Those DC machines that have arc-resisting barriers between commutator collector arms and similar material covering the windings, have fared better than the simple open type in the exclusion of water, sand and fire itself.

Fire - extinguishing liquid can easily be directed upon them. Even though the winding insulation may be destroyed by heat, the stator and rotor can usually be rewound. Cases have occurred, however, where water has been directed on to the iron bedplate, and on to the stator, causing them to crack or break, due to too rapid cooling.

Often, the main step-down transformer is close to the rotary convertor, and an oil retaining barrier should be built between the two. A difficulty may arise here, due to the AC starting panel being fixed in between the transformer and the convertor. Even so, a dwarf wall should be constructed, in which case the cable entry into the machine pit must be sealed, since if burning oil were discharged under the machine the flames would be fanned by the rotating parts. As in all indoor electrical installations, all jute

servings must be removed from the cables and preferably replaced by tape of fire-resistant material.

The shrouding put round steam turbines for protection from bomb splinters is adequate for incendiary bombs. A good example of this form of protection is shown in Fig. 2, which was designed by Mr. Valentine of Messrs. Balfour, Beatty & Co., Ltd. Good protection is required for oil pipes and tanks, especially at the high-pressure steam end. Here are all the controls for the machine. It is impracticable to enshroud the gear entirely in concrete or brickwork, as on the main body of the plant.

Fire is more likely to be caused at the high-pressure end by splinters and debris puncturing lubricating or control pipework than by incendiary bombs. Serious consequences may arise if oil is set free alongside the steam chest, especially if there are any cast-metal parts in the oil pipework. In other respects similar remarks apply to turbines as to rotary convertors. Important auxiliaries such as extraction pumps, feed-water heaters and oil filters when installed in the basement are protected by substantial brick walls.

In the Boiler House

The surface of water-tube boilers if not properly cleaned become thick in coal dust and fly-ash, which, owing to its situation, can readily catch fire. Galleries and ladders for soot blowers, valves, cleaning manholes, steam and water pipes, and blow-down connections all tend to make places in which incendiary bombs can lodge.

In many stations the boiler house roof is only of thin material that can be pierced by incendiary bombs which may come to rest in a coal bunker. Sometimes such bombs have become buried in the coal and have thereby been deprived of air to support combustion.

Protection for motors, starters and fuses falls into three groups, *i.e.*, improvements in design, suitable location and external protection. The first includes the provision of a fire-insulating layer to retard the rate of heat transmission to vulnerable parts, the heat-insulation of air spaces, the closing of continuous air passages through which flames or hot air can pass to vital parts, avoidance of metals of different coefficients of expansion where these are firmly fixed together, improved stress patterns, and the use of more ductile materials. A good number of spare parts and complete units should be provided. The stock should be well dispersed, and spares should never be stored near to the plant for which they are intended.

Cast metal parts have often been broken by immersion in water after being heated by fire. Feet of motors and starters have been found to be particularly vulnerable in this respect, especially if they have a sharp change of contour. Porcelain fuse handles, and even those of a plastic material, fracture and splinter with heat and can be shattered by quick chilling. Damaged gear should be returned to the makers for re-winding or to a reputable repairing concern. Opportunity should always be taken to replan the electrical equipment whenever it has been destroyed.

Inflammable material should never be stored underneath wall-mounted motors and starters. Totally enclosed equipment of the conventional type has fared reasonably well, although windings are usually ruined if their temperature exceeds 300 deg. F. Open and semi-enclosed types are liable to damage by water, if they are not destroyed by fire, but designs which are not only totally enclosed, but also incorporate an air-cooling system within the stator have fared very well.

Wiring and Conduit

External wiring will probably be destroyed by fire or by the water used in extinguishing it. Non-burning covering for cables of small section has the advantage of not transmitting fire, although it may be damaged locally. The heat may be so intense as to char the contents of even ironclad switches; their cases like those of main switchgear, may be broken by water or other forms of liquid fire-extinguishing medium while they are hot. With conduit installations the internal wiring will probably be burnt, though sometimes the conduit may only be full of water.

Conduit to machines, sunk in a concrete floor, comes through a fire well, although again it may be filled with water and their terminations above ground may be badly burnt and distorted. When above a ceiling, it may be damaged from below, especially if the laths for the plaster catch fire.

In conclusion, I wish to thank my superior officers and colleagues for the help they have given me in compiling this and previous articles relating to air-raid damage.

Battery Manufacture in Canada

THE number of different kinds of storage batteries Canadian producers may manufacture was limited to six in an Order made recently by Mr. A. L. Brown, administrator of electrical equipment and supplies for the Wartime Prices and Trade Board. The Order specifies five standard battery types and leaves it to the manufacturer to decide the nature of his sixth model. Production for the National Defence Department and for the Department of Munitions and Supply is not subject to the regulations. All storage batteries are to be of one grade only, while radio storage batteries must be manufactured in one prescribed type. Batteries must not bear a brand name. Batteries produced for rental are to be plainly marked by the manufacturer with the word "Rental." There are restrictions also as to the use of lacquer and paint, and upon dummy or cut-away batteries for display or demonstration purposes.

News from Eire

Electricity in Agriculture. *Work of Research Bureau.*

A SIGN that Eire is becoming more "electrically minded" which has been noted by our Dublin correspondent is the attention paid by both the lay and engineering Press to the recent address by Mr. J. A. Kenny, chairman of the Irish Centre of the Institution of Electrical Engineers (*Electrical Review*, December 4th). Mr. Kenny's statement that apart from the Liffey and the Shannon there are other rivers in the State where 100,000 HP awaits development is featured, for instance, by the *Leader* and other reviews. It is recognised that the electrical development possible must necessarily be post-war, as equipment is not at present obtainable, but Mr. Kenny's suggestion that the preliminaries can be started at once is welcomed. If the drafting of legislation and the drawing up of plans and specifications are attended to now construction can be commenced immediately the war is over.

Electric Ploughing

Main line and not merely suburban railway electrification, and canal boat propulsion by electricity, have been proposed by Mr. Kenny and other engineers. Another scheme advocated is electric ploughing. If such ploughing became practicable, the demand for electricity in Mr. Kenny's opinion, would be enormous. This type of ploughing has many advantages ; it compensates for bad weather spells by the extent of the areas that can be covered in a single day, and makes deep ploughing easy. According to Mr. Kenny, the all-in cost, covering depreciation and interest, with electricity at a penny per kWh, would be less than with a paraffin-engine propelled tractor.

The *Irish Builder and Engineer* has little doubt that electricity will play an increasing part in the future developments of agriculture, and suggests that the additional demand will help to smooth out some of the uneconomic peak loads that now handicap many electrical enterprises. It is noted that good results have been obtained on the Continent with electrically driven ploughing machines fed through a cable from automatic winding drums.

Writing in the same journal, Mr. Thomas Garland, B.Sc., A.M.Inst.C.E., says that electricity may also have a direct bearing on farming methods. At Rothamsted in England, for example, the tractive power required to haul a plough has been reduced by 30 per cent. with the aid of a small battery or generator used to give a negative charge to the moulding board. This charge attracts the moisture to the surface of the soil, where it comes into contact with the breast of the plough, thus providing a film of lubricant that greatly reduces the adhesion and friction between the clay and the surface of the metal.

The Liffey Scheme

Mr. Lemass, the Minister for Industry and Commerce, replying to a question by Deputy McGilligan in the Dail on December 11th, said that a substantial portion of the equipment for the Liffey power station had been delivered and was already erected. Small supplies of material had arrived since March last, but the major part of that outstanding remained to be delivered. The Minister added that he was unable to tell the Dail when the plant would be placed in commission.

Progress of Research

Mr. de Valera, in a recent speech in the Dail, gave details of the many and varied activities of the Emergency Scientific Research Bureau during 1942. The occasion of this report was the moving of a supplementary estimate of £5,000 which increased the total net estimate up to March 31st next to £24,500.

This review showed that it had been possible to obtain a sufficient quantity of essential products which it was once feared could not be manufactured in Eire. Elaborate laboratory tests were in many instances on the point of completion, and products were gradually emerging from the experimental stage, some having already passed into commercial production. Outlay had been incurred mainly in the investigation of fuel problems, the production of supplies for refrigeration, chemical research and the production of carbon electrodes and batteries, etc.

In the seven months to October 31st about £5,000 had been spent on investigations into the production of turf charcoal, and it was expected that regular production of this charcoal would commence in the near future.

Mr. de Valera said that the investigations included research into the production of iron by electro-deposition. Following satisfactory laboratory experiments, the production of electrolytic iron on a large scale was being studied with specially adapted plant and equipment. It was hoped that production would commence in the near future.

During the year an investigation was commenced into the possibilities of producing electrodes suitable for use in electric furnaces. Preliminary experiments carried out in gasworks were sufficiently encouraging to justify further work in collaboration with an industrial firm. A special furnace had been erected and electrodes suitable for use in the manufacture of calcium carbide had been produced.

An investigation was in progress with a view to arrangements being made for the repair and manufacture of lead batteries in the country. A study had been made of the treatment of wood for the production of the separators, and experimental work had been carried out in a specially constructed furnace to prepare lead oxides.

A New Amplifier

Professor John J. Dowling, M.A., lecturing on the work of the Bureau at Trinity College, Dublin, announced that a new amplifier to increase the power of the short-wave broadcasting station at Moydrum, Athlone, had been constructed as a result of the work of Dr. E. T. S. Walton. It was now in the course of re-erection at Athlone where the final experiments would be made. This was described by Prof. Dowling as "one of the major experiments."

Water Power in Scotland

Proposed Development Board

A REPORT has been issued by the Scottish Office on Hydro-Electric Development in Scotland (Stationery Office, 9d. net). This was drawn up by a Committee which had as its chairman Lord Cooper and included Lord Weir and Mr. James Williamson, M.Inst.C.E.

Its terms of reference provided for consideration of the practicability and desirability of further development in the use of water power in Scotland for the generation of electricity and for a recommendation regarding the type of body that should undertake such developments (if any), due regard being paid to the general interests of the local population and to the amenities.

Policy and Recommendations

The Report embodies a programme of policy, without working out its practical implications in detail which would have been impracticable under present conditions. The main recommendations made are as follows:—

(1) A new public service corporation of five members, called the North Scotland Hydro-Electric Board, should be set up. The Board would appoint its deputy-chairman who would possess wide experience in electricity supply and commerce and would be the whole-time chief executive officer. One member would be a member of the Central Electricity Board. The chairman and the other two members would be appointed by the Secretary of State for Scotland and the President of the Board of Trade and remunerated for part-time service.

(2) The Board should develop all further public generation in the northern area of Scotland and supply existing undertakings in bulk. It should also be responsible for generation, transmission and distribution in all areas not supplied by existing undertakings.

(3) The three primary aims should be to attract to the Highlands electro-chemical and electro-metallurgical industries, to develop all further power required for consumers of existing undertakings or in the Board's distribution area (the surplus being "exported" to the grid) and to develop on an experimental basis schemes in isolated districts.

(4) Priority should be given to local demands for power.

(5) All necessary powers and financial facilities should be given to the Board as a non-profit-earning public service corporation.

(6) The new Board, the C.E.B. and the Grampian Co. should be empowered to enter into agreements for bulk supplies, for the joint use of the company's transmission lines and new transmission lines and for terms on which the grid would take surplus supplies.

(7) Supplies to the undertakings should be given by the new Board at cost subject to provisions, as in the 1926 Act, to ensure that benefits of economies are handed on to consumers. The C.E.B. should pay for supplies taken not less than the price paid for supplies from the most efficient steam stations in Scotland under agreement conditions and at coal prices ruling in the Central Scotland area.

(8) Profits from sales to the C.E.B. would be used for developing supplies.

(9) The new Board should co-operate in schemes for the regeneration of the Highlands.

The Report includes a historical survey of the various major attempts to utilise the water resources of Scotland from the Foyers station of the British Aluminium Co., which was opened in 1896, and was followed in 1909 by the Kinlochleven station of the same company. In 1921 the Water Power Resources Committee estimated the potential continuous hydro-electric capacity of Scotland as 217,965 kW, of Wales as 35,900 kW, and of England as 20,440 kW. The first water-power stations to be built for public supply in Scotland were the two of the Clyde Valley Co. in 1926. The Grampian Co. opened two in 1930 and 1933 and the Galloway Co. five in 1935-1936.

Two schemes, the West Highlands and Glen Affric, were rejected by Parliamentary committees in 1929 and the Caledonian Power Scheme covering the same ground as the former, but designed for calcium-carbide production, was rejected in 1936, 1937 and 1938. The second Glen Affric scheme failed to secure Parliamentary approval in 1941.

Nature of Opposition

It is remarked that the opposition of landowning and sporting interests and of the Mining Association have been important factors in these reverses and that the whole subject has become involved in suspicion and embittered controversy.

Approval is given to the arrangement under which the northern area of Scotland has not been included in a scheme of the C.E.B., as the territory (except Aberdeen) is substantially covered and well-served by the Grampian Co., which operates over 10,000 sq. miles with a population of 414,000. Nearly 1,500 miles of 132- and 33-kV transmission lines and numerous 11-kV lines and lower-voltage networks have been provided by the company, which at the end of 1940 had connected 22,000 consumers, 20 per cent. of the premises

in its area, and in addition was giving bulk supplies to ten authorised undertakings. More than 63 million kWh was sold in 1940 at an average price of 1·55d. in addition to 106 million kWh supplied to the C.E.B. The total capital expenditure incurred by the company is £6 million; an average yield of 3·8 per cent. had been received between 1930 and 1940.

Within the northern area are fourteen other authorised undertakings, six of which are associated with the Grampian Co. Four generate their own supplies in whole or in part. Outside the Grampian limits in the north there are on the mainland only three undertakings and in the Hebrides two. Throughout the greater part of the mountainous districts outside the Grampian Co.'s area a public supply system is regarded as totally impracticable.

The northern area of Scotland thus differs fundamentally from Great Britain owing mainly to its sparse population and absence of coal, so that the policy embodied in the 1926 Act is inappropriate, although the development achieved would have been impossible but for the arrangements made with the Central Electricity Board. Objections to the use of the Highlands " as a power house for the Lowlands " are answered by the impracticability of building up a supply system in so thinly populated an area unless a market can be found for the initial surplus of power.

In comparing the costs of hydro-electric and steam projects, the price of coal (at present 27s. 6d. per ton in Scotland) has tended to increase since the Water Power Resources Report was published in 1921, when the figure was taken as 10s. per ton.

Annual Charges and Rates

Moreover, 5¼ to 6½ per cent. on the capital expenditure more clearly represents the probable annual charges on a water-power plant in the future than does the 8 per cent. expected by the Water Power Resources Committee. Both trends, together with greater efficiency of water turbines, improve the prospects for hydro-electricity. On the other hand the latter is handicapped by an obsolete local-rating system. Whereas for a steam plant fuel costs are deducted in making the assessment, no corresponding rebate in respect of the annual charges on civil engineering works, which are the counterpart of the fuel charges, is permitted for a water-power station. The rates on the latter are therefore generally about three times those paid on an equivalent steam station. The Committee recommends that hydro-electric plants should be exempt from rates for at least a prolonged development period.

An interesting technical feature is the proposal to construct some of the transmission lines for 264 kV. Provisional estimates have disclosed some seventy hydro-electric schemes as capable of economic development to the extent of 450,000 kW in continuous operation.

Proposed Government Action

In the House of Commons on December 15th, Mr. Johnston, Secretary of State for Scotland, said that, while particular recommendations in the Report were still under consideration, its general conclusions were accepted by the Government and legislation to implement them would be introduced as soon as possible after the Christmas recess.

Testing Metal Foils

ATTEMPTS to devise a simple objective test of the stiffness of metallic foils (for milk bottle capping) led to a general investigation of their mechanical properties, which is described by Dr. B. Chalmers and Mr. P. W. Seddon (Tin Research Institute) in a paper issued by the Institute of Metals.

The specially contrived instruments employed are described and illustrated diagrammatically. For tensile testing the specimen is strained at a constant rate, the load being measured by means of an electromagnetic dynamometer (British patent 502,500) consisting of a steel diaphragm whose distance from a U-shaped core of " Stalloy " is altered by its flexure. Rotation is caused through a train of gears by a constant-speed motor. The usual circuit indicates variations in the gap between the poles of the dynamometer core and the diaphragm by means of the deflection of a galvanometer. The spot of light reflected from the latter's mirror is focused on to a moving screen, or photographed, so registering force/deformation graphs.

For static bend tests small continuously variable known forces are applied to the specimen by means of the repulsion between a magnet and a coil through which DC flows in the appropriate direction. The force is proportional to the current when the coil is at a fixed distance from the magnet, the distance between them being adjustable by a permanent magnet below the coil. The instrument is of the balanced beam type ; leads from the coil at one end of the beam dip into two mercury cups which are connected to a 6-V battery with a rheostat and milliammeter in series. At the other extremity of the beam a pointer can be kept at zero with considerable accuracy. A rod projects vertically upward from the beam fulcrum, terminating in a knob which applies contact force to the apex of the specimen, causing it to bend in a manner that excludes the effects of gravity. The instrument is calibrated in such a way as to relate the force exerted to the current needed to bring the deflected balance beam back to zero position.

Sensitivity is indicated by definite movement of the beam with a current change of 0·1 mA, corresponding to a force of 0·2 mg. on the specimen foil.

For dynamic bend testing deformation is caused by an equiangular spiral cam rotated against the specimen by a small motor. At the end of the travel the force applied to the specimen is removed and its behaviour observed, by projecting an image of the specimen on to a screen through an optical magnification system.

Electricity in Shipyards

Machines and Methods

THE electrical equipment of shipyards is dealt with in a paper prepared by Mr. H. M. Coatsworth for the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-upon-Tyne ; it is mainly descriptive and explanatory of recent practice in the shipyards with which the author is connected.

The relative merits of AC and DC are pointed out, regard being paid to the facts that DC motors are generally 2·5 times more expensive than AC types and that DC characteristics are seldom really needed in shipyards. Substation lay-out and the desirability of sectionalisation and limitation of transformer capacity are briefly referred to. Cable sizes are not easy to assess, normal procedure being to assume a diversity factor of 35 per cent. It is advisable to lay distribution cables in ducts, to facilitate maintenance and reinforcement, particularly as the ground largely consists of ballast filling which is acid.

Types of motors, protective enclosure and methods of starting them are discussed at some length. The ventilated drip-proof type will normally be adequate for shipyards and associated machine-shop use ; if placed out of doors some additional protection against driving rain will be needed. In foundries, joiners' shops, pattern shops and sawmills it may be necessary to install the more expensive totally-enclosed type, but the author has not experienced any trouble with protected motors if they are regularly cleaned with a portable machine that can be used both as a vacuum cleaner and blower. Incidentally, the circulation of current at low voltage through the windings for lengthy periods is preferred to storing motors that have to be dried.

Types of Drive

The author has found that with a total transformer load of about 800 kVA it is quite practicable to start 20-HP squirrel-cage motors direct on the line. The majority of machines commonly found in shipyards, which run continuously, such as punches, shears, drills, or blowers, are fitted with squirrel-cage motors and a flat belt when there is a flywheel. Such drives enable a standard AC, six-pole, 1,000-RPM motor to be used for almost any machine, sufficient speed reduction being obtainable by selecting the right size of pulley. Short pulley centres are possible with V-rope driving, enabling the motor to be mounted on the frame of the driven machine. With appropriate pulleys this type of drive is satisfactory even when heavy reversing duties are imposed. Electrical equipment built into machine-tools is not accessible and there is insufficient provision for preventing the cooling lubricant and swarf from short-circuiting wiring and starters.

So far as shipyards are concerned, automatic control is probably most necessary for hydraulic pumps used to press up accumulators, for which squirrel-cage motors of the high-torque type have been used instead of the more usual slip-ring type. The "Lancashire" AC/DC drive for planing machines has proved to be nearly fool-proof and most satisfactory wherever heavy reversing duties and accelerated strokes are involved. Blacksmiths' 1-HP and plumbers' 2-HP hearth fan blowers are more economical and convenient than the use of compressed air from the pneumatic mains.

Riveting and Welding

For boilermaking and hydraulic riveting it is quite feasible to employ electric rivet-heating machines, not necessarily portable, for work which normally involves a good run of rivets of equal size. The estimated saving of electric over coal heating is about £20 per year, which is an appreciable portion of the total cost of the heater (£120).

In comparing AC and DC welding the author suggests, in place of mobile DC sets, a series of stationary generators energising ring mains round berths and pre-fabrication shops, which operators can tap close to their work. In the shipyard with which he is connected AC 12-operator sets allow for paralleling two points to a 600-A regulator, or for paralleling two 300-A regulators. AC welding has been adopted throughout a scheme recently drawn up by the author for a four-berth yard, including welding shop, and the fitting-out basin ; general lay-out plans and cable sizes are included in the paper.

The importance of an efficient earthing system cannot be too strongly emphasised. Surprising results are obtained if resistance is measured when relying on the ship as a conductor. It is therefore suggested that an earthing ring should be run round the ship and connected to the neutral point of the transformer ; welders would then earth their jobs to the ring, which can be attached to a copper rod driven vertically into the ground.

Reference is made to means of correcting power factor, the author remarking that an uncorrected welding value of 0·35 may advantageously be improved up to 0·66. Shipyard lighting is briefly mentioned, the author feeling that its practical and economic aspects are worthy of expert consideration ; very little information on this subject has been

published. For the internal illumination of ships under construction temporary ring mains are advantageous though rather more expensive in first cost, single-phase, 30-kVA, 440/110-V transformers being conveniently connected to any distribution board.

Standardisation

When changing over from DC to AC the author standardised electrical equipment in order to secure interchangeability and simpler maintenance. In many cases of shipyard machines that are loaded intermittently, the overloading of a motor of a size below the machine maker's recommendation (deliberately selected to preserve standardisation) has not caused any trouble. In fact the motor has worked considerably nearer to its maximum rating when operating under average conditions with correspondingly better efficiency.

Routine inspection and systematic testing are advocated, in which connection attention is drawn to the fact that insulation resistance is diminished by humidity of the atmosphere; it is also lower when hot than when cold, and therefore it is recommended that tests should be made at a set time after the plant has been shut down.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Electricity Supply Tariffs

THANK you for devoting so much of your valuable space to the discussion of the above subject. Many others besides Mr. Harling and myself want to find a solution to the problem of how to devise a tariff which will have a common basis and be applicable to all loads, and it is only by full discussion that we are able to see the flaws in suggestions that we put forward.

Referring to Mr. Harling's letter, my proposed tariff would include *all* standing charges of generation and distribution in an annual fixed charge which is known in advance with a running cost of so much per 100 kWh, plus a coal clause. Taking Chester as an example, the 1937 fixed charge of say £63,000 would be known in advance ; the kWh sold in 1936 was 21 millions. This divided out gives 0·72d. per kWh. The fixed charge for 1937 would amount to 6s. 0d. for every 100 kWh used during 1936. The kWh charge, which would include adjustment for coal, would be say 5s. 3d. per 100 kWh. This would give an average of 1·26d. per kWh on the 24 millions sold in 1937, and the m.d. would have no bearing on it. There would be no gambling on the weather, and the fixed charge could be varied if desired to meet special local overhead charges, with no fear of the undertaking making a loss or an excessive profit.

I am entirely in agreement with Mr. Harling about a single meter, but I do not like his suggestion of a maximum demand indicator attachment. This would most certainly add to the costs of metering and meter reading, and I would not like the job of explaining to irate consumers the reason for charging back for the whole year a high demand which was registered during the last two or three weeks of any year.

His statement that the cost of electricity supply is inseparably connected with maximum demand and more particularly with load factor, is not borne out by facts. If Chester generating station was called on to provide an additional 2,500 kW for an hour on any day of the year, would it cost £10,000 or more on the standing charges of that year ? The answer is a decided " No ! " Ought we to charge a domestic consumer a high price when he uses electricity in the early morning and late evening on week-days, and has a high demand on Sundays because he has a poor load factor ? My contention is that these diverse loads add up to improve the load factor of an undertaking.

With the suggested restrictions on off-peak loads I fail to see how anybody can forecast what the maximum load will be. The signal may be sent out a number of times, and some other load can easily upset all calculations in the last few weeks of the financial year. In any case, a big increase in the price of the on-peak units would not compensate the undertaking for the increased cost of the demand.

I have never suggested that generally I could supply the necessary mains and services for a thousand consumers at the same cost as for a single consumer with the same load as the aggregate of the thousand. But a special case might prove even this to be possible. What I do say is that I am in an undertaking which does supply several thousands of domestic consumers who use an average of 2,500 kWh per annum at approximately the same price as a number of power consumers who have loads of several hundred kilowatts each. A large number of these domestic consumers, about 65 per cent. of whom cook by electricity, have connected loads in excess of 10 kW, and the diversity is much better than 5 for the group—10 would not be an over-estimate. The load factor of this group is from 28 to 35·5 per cent., and if some of the individual load factors are from 1·5 to 5

per cent., as quoted by Mr. Harling, then others must be from 50 to 60 per cent.

The wide difference of the diversity and the load factors shown above illustrates the futility of trying to base a tariff on the m.d. These figures vary from district to district, and are liable to change in any area from year to year. In conclusion I would like to ask Mr. Harling if he can put forward a really sound reason for retaining the m.d. charge after the war.

B. CROWSLEY,
Welwyn Garden City. *Mains Engineer.*

IT is encouraging to see that the much debated subject of tariffs is still keenly alive and I sincerely hope that your correspondents have all answered the appeal of the I.E.E. Post-War Planning Committee and sent in constructive ideas for tariff standardisation.

Mr. J. Ratcliffe supplies his own answer to the bogy of public antipathy towards scientifically constructed tariffs. His percentage basis with the different classes of supply needs more explanation. A nationally declared price would only be possible by complete nationalisation.

A broad conception of post-war planning includes a control of methods of load development and distribution planning which would help to level supply costs and no doubt steps will also be taken to ensure a more equitable " grid " charge to the various undertakings.

In answer to Mr. R. B. Rowson, the total average annual cost per kWh is already an established item for electricity undertakings. Contributions towards rates should not form part of the cost ; they are a (regrettable) method of disposing of excess profits. Legislation would have to be introduced to tighten the control of capital expenditure and profits for both municipal and company undertakings.

My tariff is expressly designed to give a non-linear variation, as the cost price per kWh does not vary in direct relation to the load factor.

Present tariffs, with all their faults, are designed to give a reasonable return for the running costs and capital expended. Any tariff which is to be standardised must fit in with existing costs and revenue so that it can be introduced with the least interference with existing satisfactory conditions. It is the multiplicity of tariffs that is in the greatest need of correction. On this basis the proposed tariff has been designed and the apportionment of the three classes of load worked out. The following examples of this tariff applied to existing consumers with representative loads will give a clearer conception of its effect than any theoretical treatise based on hypothetical figures.

With regard to the maximum-demand indicators, as several million watthour meters would be released by the use of one meter per consumer the cost thus saved could be credited towards the cost of demand indicators instead of additional watthour meters otherwise required for post-war re-housing and development.

The usual " red herring " of nationalisation appears somewhat to prevent a clear conception of the principle of the suggested tariff. Whether it is applied to obtain a national standard price in the event of nationalisation or as a standard basis for apportioning individual electricity authorities' costs does not affect the principle of its application, which was clearly stated in my article and in my reply to Mr. B. Crowsley.

I do not claim that my suggestion is ideal, but if it helps to point out a pathway through the present tangle it will have achieved its object.

Chester. S. C. HARLING.

COMPARISON OF SUGGESTED NEW STANDARD TARIFF WITH EXISTING TARIFFS

TYPICAL CONSUMERS	M.D. (kW)	M.D. (kVA)	kWh	L.F. (kW) per cent.	L.F. (kVA) per cent.	Average prices per kWh	
						Existing Tariffs	New Tariff
Pumping station (off peak)	294·0	338·0	2,269,440	87·5	75·3	0·48d.	0·41d.
Works canteen	40·0	40·5	133,672	37·2	37·2	0·78d.	0·86d.
Works canteen (off peak)	40·0	40·5	133,672	37·2	37·2	0·6d.	0·52d.
Multiple stores	39·5	41·5	99,206	28·75	27·3	1·67d.	1·02d.
Engineering works ..	120·0	140·0	219,084	20·8	17·8	1·32d.	1·26d.
Domestic (l., h., w.-h. & c.)	11·0	11·2	14,000	14.5	14·3	0·67d.	0·51d.
Domestic (l., h., & w.-h.) ..	5·0	5·1	367	0·84	0·82	1·09d.	1·72d.

A Textbook Inquiry

I HAVE a good deal of sympathy with " Inquirer," Sheffield, whose letter is published in your Correspondence columns of December 11th. There are many office workers, more particularly under present conditions, who have little technical knowledge, but are, nevertheless, compelled to attempt to deal with requirements for electrical equipment, and manufacturers and suppliers have to be on the alert to recognise such lack of knowledge, and to give service by advice where necessary.

In similar cases to that of " Inquirer " I have found that a very excellent book is " Alternating Current Motors and Control Gear " by C. H. Claude Cooke, Grad.I.E.E.,

published by Crosby Lockwood & Sons, Ltd. Very valuable information can also be gleaned from a study of electric motor manufacturers' catalogues, leaflets and handbooks, and for the information of " Inquirer " I am sending suitable matter herewith for you to kindly forward.

I would further recommend that your correspondent should attend a lecture which is to be given in March by Mr. A. E. Cunningham on " The Choice of Three-phase Industrial Motors," invitation to which can be obtained on application to Mr. J. H. H. Teece, Secretary, Sheffield Students' Section, I.E.E., c/o Metropolitan-Vickers Electrical Co., Ltd., Howard Gallery, Chapel Walk, Fargate, Sheffield 1.

Guiseley, Leeds. W. LACY,
Estimating Department,
CROMPTON PARKINSON, LTD.

[The " literature " sent by Mr. Lacey has been passed on to " Inquirer." It included AC and DC installation and maintenance handbooks, leaflets on squirrel-cage and slip-ring motors and on electric power in paper mills and other industrial establishments. — EDS., *Electrical Review*.]

The Central Register

IN your last issue of 1941 you published a letter of mine in which I made some pointed remarks regarding the Central Register, now incorporated in the Appointments Branch of the Ministry of Labour. After eleven months the Select Committee on National Expenditure has arrived at conclusions similar to those adumbrated in my letter. The Committee, whose findings you reported in your November 20th issue, calls attention to :—

(1) " The practice, frequently erroneous, of allowing academic qualifications to overshadow practical experience gained in workshops, as a measure of suitability." (2) " The shortage of persons of managerial capacity."

The Central Register tabulated 29,404 electrical and 63,643 mechanical engineers in a total enrolment of 170,357. From this total 19,000 appointments have been made, leaving a considerable balance still on the Register and presumably available for appointment. In view of this balance it is strange that in the same issue of the *Electrical Review* an advertisement appears for experienced station engineers, applications to be made to the Central Register.

What has happened to the balance on the Register ? Is it unable to produce the men required ? Does it find itself short of men who have " practical experience," *i.e.*, the men who were told they were " unsuitable " for inclusion in the Register ?

It would appear that the time has arrived when a new register of practical engineers is necessary (some undoubtedly possessed of managerial capacity) who can get a job going and keep it going without academic qualifications but with sufficient technical knowledge to support their practical experience.

From my personal knowledge there are men who *were* eager to co-operate in the national effort, but experience of the Ministry of Labour's mandarins (possessed no doubt of a surfeit of " academic qualifications ") has convinced them that the nation's requirements cannot be so urgent as they were led to believe. The ability and experience both practical and managerial are available; when will Mr. Bevin's advisers start " directing " it into the appropriate channels ?

A.H.G.

An Engineers' Centre

WITH reference to plans for reconstruction which are being discussed by various committees, I would like to suggest that consideration should be given to the establishment of an " Engineers' Centre." This building, which might be located in the vicinity of the new University of London headquarters, could be used for accommodating professional engineering institutions of recognised status, and it is suggested that the Centre would :—

(1) Ensure that lecture halls, committee and council rooms, etc., of various sizes, would be used to the maximum extent (by mutual arrangement of the institutions concerned).

(2) Help some of the smaller bodies which do not possess, and cannot afford, permanent premises for the holding of meetings.

(3) Enable greater personal contact to be maintained between members of kindred institutions. This is of great importance due to the ever-growing tendency towards specialisation.

(4) Represent a perfect example of the capabilities of engineers (unfortunately many institutions are to-day housed in buildings which are not in keeping with modern engineering practice).

(5) Reduce overhead expenses (fixed and running) and increase general administrative efficiency.

There are many other advantages which would result in practice and if an Engineers' Club could also be included it would satisfy an ever-growing need. I believe that an idea such as the above, has been put into practice in New York with great success.

Bath. J. B. HARRIS, Grad.I.E.E.

Radio Manufacture in Brazil

According to the *Bulletin* of the Brazilian Federal Council of Foreign Trade, a special State Commission has recently been appointed to study plans for the establishment of an industry in Brazil for the manufacture of radio communication instruments and apparatus.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Minister of Fuel and Power has appointed the members of the National Coal Board under paragraph (b) of the White Paper on Coal. **Major Lloyd George** is himself chairman of the Board, the members of which include **Col. S. E. Monkhouse** (representing the Joint Committee of Electricity Supply Associations) and **Sir Geoffrey Clarke** (representing the F.B.I. and the Association of British Chambers of Commerce).

A District Committee for the Ipswich and Colchester area has been set up under the Eastern Regional Board of the Ministry of Production, and **Mr. F. Ayton**, M.I.E.E., M.I.P.E., a director of Ransomes, Sims & Jefferies, Ltd., and a member of the Regional Board, has been appointed chairman. The members include **Mr. G. Woods,** managing director of M. W. Woods, Ltd.

Mr. S. R. Windle

Mr. S. R. Windle, who, as we briefly announced in our last issue, is to retire in March next year, has been chief electrical engineer at Grimsby since 1928. He was previously in charge of the Doncaster electricity undertaking for eight years, during which period plant extensions were carried out. Prior to his Doncaster appointment he was for about ten years chief assistant to Mr. A. S. Blackman, the then general manager of the Sunderland electricity undertaking.

Subject to the approval of the City Council, Norwich Electricity Committee has appointed **Mr. G. V. Harrap,** A.M.I.E.E., technical assistant with the West Ham Corporation Electricity Department, as deputy city electrical engineer.

Enfield Cable Works, Ltd., announces the appointment of three new members to the board of the company, to take effect from January 1st, when **Mr. L. A. Booth,** Assoc.I.E.E., takes up his duties as sales director, **Mr. P. F. Deakin** as works director, and **Mr. F. W. Main,** M.I.E.E., as technical director. These three gentlemen have been continuously in the company's service since 1935, 1919 and 1928 respectively.

Edinburgh University Court has appointed **Professor S. Parker Smith,** Glasgow, as examiner for degrees in the Faculty of Science—Electrical Engineering; **Professor A. L. Mellanby** for Civil and Mechanical Engineering; and **Professor T. D. Jones,** Cardiff, for Mining and Mine Surveying.

A gift of £10,000 for the development of the Engineering Department has been made to Glasgow University by **Mr. F. C. Stewart,** chairman of the Thermotank Engineering Co., Ltd., and of Kelvin, Bottomley and Baird.

Mr. F. H. Schroeder, sales manager of the smaller range of motors of Lancashire Dynamo & Crypto, Ltd., has been appointed a director of the company.

Mr. A. G. Erskine Hill, M.P., has been appointed to the board of the Scottish Power Co. in the place of the late Sir Robert Brooke, Bt.

Obituary

Sir Herbert Blain.—The death occurred on December 16th at Burgess Hill, at the age of seventy-two, of Sir Herbert Edwin Blain, Kt., C.B.E., M.Inst.T., who was well known for his work on the London Underground Railways. He was born at Liverpool, where he was educated at the Technical College, and he commenced his career with the Corporation, with whom he became principal traffic assistant of the tramways. In 1903 he went to West Ham as the tramway manager, and ten years later joined the London Underground Railways and the London General Omnibus Company group as purchasing agent, being appointed operating manager in the following year and subsequently becoming assistant managing director in 1921.

In 1924 he was appointed principal agent of the Conservative and Unionist party, a post which he held for three years. He was president of the Municipal Tramways Association in 1910-11, and was founder and ex-chairman of the National Association of Local Government Officers, founder and vice-president of the London Safety-First Council and the founder and a past-president of the National Safety-First Association. He was an honorary life member of the Institute of Transport and an ex-member of the Technical Committee on London Traffic. He became a C.B.E. in 1921 and was knighted in 1925.

Mr. F. Johnson.—The death occurred in a London nursing home on November 19th, after a long illness, of Mr. F. Johnson, at the age of forty-eight. Mr. Johnson had been chief electrical engineer for many years with the Appleby-Frodingham Steel Co., Ltd., Scunthorpe, and at the outbreak of the war was appointed chief engineer. He received his early training with Wilton's Engineering & Slipway Co., Rotterdam, and carried out Admiralty work during the last war, going to Scunthorpe when the plate mills were being put down in 1918. Mr. Johnson leaves a widow and two young children.

Mr. T. Kearns.—The death occurred at Blackpool on December 15th of Mr. Thomas Kearns, who, until his retirement in September of this year, was installation inspector with the Blackpool Corporation Electricity Department, which he joined in 1905. He leaves a widow and one son.

Wills.—The late **Mr. J. J. Rawlings,** chairman of Rawlplug, Ltd., and a director of the Sun Electrical Co., Ltd., and Rawlings Bros., Ltd., left estate valued at £51,381 (£28,538 net personalty).

Mr. J. Fraser, a director of the General Electric Co., Ltd., left £69,618 gross with net personalty £54,529.

COMMERCE and INDUSTRY

Lease-Lend Battery Prices. Non-Ferrous Metal Control.

Waste-paper Collection

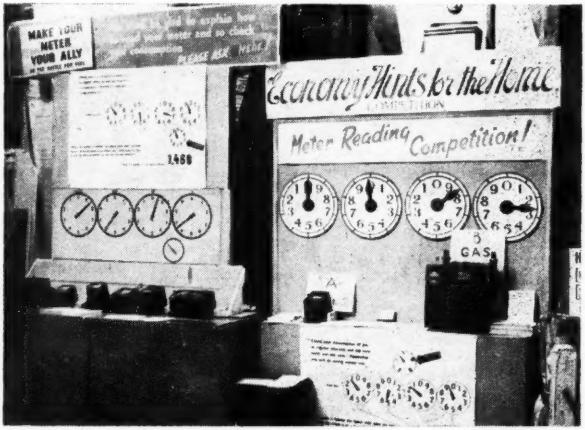
THE close of the year is a suitable time for overhauling systems which have been in operation for some time and seem to be carried on by their own momentum. Among them should be considered the arrangements for collecting and disposing of waste paper. It may be that there has been a slackening-off since the first enthusiastic drive ; indeed, the decline has been very noticeable in some directions.

The need for paper in the production of munitions of all kinds is greater than ever and so we again appeal to readers to make sure that every scrap is picked up and disposed of. In this, as we have said many times before, assistance can be obtained from the Electrical Industry Waste Paper Recovery Committee, 2, Savoy Hill, W.C.2. We may also give a reminder that it is a good idea to pass on the proceeds of waste-paper sales to the Electrical Industries Benevolent Association.

Maidenhead Fuel Economy Exhibition

On December 5th a Fuel Economy Exhibition was opened at the Town Hall, Maidenhead. The exhibition was arranged by the borough electrical engineer, Mr. C. A. Britton, and the Corporation electricity staff, with the co-operation of the Uxbridge, Maidenhead, Wycombe and District Gas Co., the Maidenhead Waterworks Co. and the local fuel overseer.

It showed in many ways how the housewife could save fuel, and each day talks and demonstrations were given on fuel problems. One of the speakers was Mr. Britton, who congratulated the housewives on what they had already done so far as economy was concerned. He said the exhibition would show them ways of saving fuel which probably had not occurred to them. He impressed upon them the importance of using electricity as little as possible between 8 a.m. and 1 p.m.



Fuel Economy Displays at Maidenhead

Battery Price Control

The Board of Trade, after consultation with the Central Price Regulation Committee, has made an Order controlling the prices to be charged by official selling agents, wholesalers and retailers of all high-tension dry batteries imported under Lease-Lend provisions. The maximum prices are set out in a schedule to the Order. The Order provides that all agents or wholesalers dealing in these batteries must supply, either before or at the time of delivery to their customers, a written notice (which can, if desired, be incorporated in the invoice) stating the correct maximum prices for the batteries in question. All retailers selling these batteries must display in a prominent position in their shops a notice giving the maximum price appropriate to any of these goods offered for sale by them. This Order, the High Tension Dry Batteries (Maximum Prices) Order, 1942 (S.R. & O. 1942, No. 2512) came into force on December 10th and is obtainable from H.M. Stationery Office (price 1d.).

Wartime Factory Appeals

An exhibition of internal works appeals that have been used to stimulate the war effort of Midland factories is to take place in Birmingham in the New Street Gallery of the Royal Birmingham Society of Artists during the week commencing February 1st, 1943. The object of this exhibition, which will be open by invitation to works executives and works committees, is to pool experience gained in personnel relations on the Midlands industrial front. Its scope extends to all aspects of the war effort in factories, including production, safety, absenteeism, welfare, economy, salvage, national savings, civil defence and Forces funds appeals.

The committee comprises the following :— Messrs. H. W. Eley, chairman (Dunlop Rubber Co., Ltd.), J. F. Bramley, hon. secretary (Austin Motor Co., Ltd.), L. H. Broadbent (W. & T. Avery, Ltd.), G. M. Hopps (Bakelite, Ltd.), H. N. Brealey (Birmingham Small Arms Co., Ltd.), J. E. Withers (Accles & Pollock, Ltd.). H. W. Richardson (General Electric Co.,

Ltd.), M. Griffiths (Hercules Cycle & Motor Co., Ltd.), L. E. Cornford (I.C.I. Metals, Ltd.), J. W. Phillips (Joseph Lucas, Ltd.) and representatives of the Ministries of Aircraft Production, Information, and Supply, which Ministries, together with the Birmingham Chamber of Commerce, are sponsoring the scheme.

An organising sub-committee has been appointed, and invitations have been issued to all Midland factories engaged on essential war work to enter exhibits such as posters and leaflets, production target boards, and displays and physical exhibits of a demonstrative type. All entries will be considered by a selection committee. Further particulars can be obtained from Mr. J. B. Bramley.

Non-Ferrous Metal Control

The Minister of Supply has made the Control of Non-Ferrous Metals (No. 11) (Copper, Lead and Zinc) Order, 1942 (S.R. & O. Nos. 2534/5/6) and the Control of Tin (No. 5) Order, 1942 (S.R. & O. No. 2532). Both Orders came into force on December 17th.

The No. 11 Order makes certain modifications in the provisions controlling the acquisition or sale of copper, lead and zinc, and ores, concentrates and specified scrap containing these metals, as it has been found necessary to provide a closer control over their use. The most important modifications are that :—(i) Persons who use not more than one ton of any of these metals per month are no longer exempted from the licensing procedure ; and (ii) additional classes of scrap and waste containing these metals are, for the first time, brought within the scope of the licensing procedure.

As hitherto, it will not be necessary for a scrap merchant to obtain a licence for the acquisition of scrap which he subjects to no process other than cleaning, crushing, or sorting. The new Order maintains the present scale of maximum prices for copper, lead and zinc, and by Directions Nos. 1 and 2, which are issued with the Order, the existing premiums and discounts on these prices for special shapes or delivery in small lots are also maintained.

Under the new Control of Tin Order, persons acquiring no more than 112 lb. of tin a month, who have been hitherto exempt from the licensing procedure, will now have to obtain a licence before acquiring any quantity, however small.

Copies of the Orders may be purchased from H.M. Stationery Office, York House, Kingsway, W.C.2, or through any bookseller. All inquiries should be addressed to the Non-Ferrous Metals Control, Grand Hotel, Rugby.

Machinery and Plant Control

The Machinery, Plant and Appliances (Control) (No. 3) Order, 1942 (S.R. & O. 1942 No. 2487, price 2d.), which came into force on December 9th, replaces previous Orders and makes substantial amendments of the additions to the Schedule of machinery, plant and appliances, the supply and acquisition, and in certain circumstances the use, of which is already prohibited except under licence from the Board of Trade. To avoid possible contravention of the Order, manufacturers and prospective acquirers of machinery, plant and appliances should obtain copies of the Order from H.M. Stationery Office or through any bookseller, and acquaint themselves with its full provisions. Application forms for licences may be obtained from the Machinery Licences Division, Board of Trade, 1-6, Tavistock Square, London, W.C.1.

Disabled Men's Work

We learn from Mr. H. Kendall-Torry, technical director of St. Loyes College for the training and rehabilitation of the disabled, Fairfield House, Exeter, that a section has been established at the College equipped to deal with all hard soldering of a light nature. The College also possesses facilities for the making of any necessary jigs or tools, and for drilling, tapping, etc., and complete assemblies of many types can be undertaken.

At present they are making electric shunts, but the scope is much wider than this and electrical firms are invited to make inquiries.

Lighting from Power Circuit

At Stoke-on-Trent recently a fine of £5 with £3 8s. special costs was imposed on an electricity consumer for using for lighting purposes electricity supplied by the Corporation for power. It was stated that a lead from a power plug in the house was taken through a window into a lampholder in a garage and on to a bungalow owned by defendant.

Shipyard Wages

In the House of Commons last week, Mr. Martin asked the Minister of Labour whether his attention had been drawn to the inequality in the wage rates for ship-repair workers in the electrical trades in different districts, and whether, since this bore hardly on workers transferred from one district to another, he would take some steps to adjust the situation.

Mr. Bevin said that the rates in operation in the various districts were those agreed between the two sides of the industry, and any readjustment was a matter for negotiation through the appropriate machinery.

Shift Workers' Wages

Mr. A. H. Banks, Employers' Industrial Adviser, has sent us copies of agreements recently arrived at with regard to the wages of shift workers in the electricity supply industry. The first relates to the rates paid to shift workers in all districts except No. 5 (North-West Midlands) and No. 10 (Greater London), in which higher rates than those for day workers are already paid ; it provides that as from January 1st, 1943, an addition of 1d. per hour above the day rate shall be paid to those working on Sundays but not on nights or those working on nights but not on Sundays, and an addition of 2d. per hour to those working both on nights and on Sundays. These will be inclusive rates, *i.e.*, as shift workers are called upon to work during the night and on Sundays and public holidays, no extra or enhanced rates will be payable in respect of such work. About 25,000 men are affected by this agreement.

The agreement does not apply to switchboard and substation attendants, whose rates are fixed by a separate agreement. The latter is amended to effect reductions in the rates corresponding

to the amounts by which the shift workers' rates are increased by the above-mentioned agreement. The amendment provides for a reduction of 1d. per hour from January 1st, 1943, in the rates fixed by the principal agreement for those working on Sundays but not on nights and those working on nights but not on Sundays. In the case of an employee working ordinary day workers' hours or on regular day shifts, excluding Sundays, the reduction will be 2d. per hour. This provision does not apply to the No. 5 District, for which a separate but similar modification of the principal agreement has been made. It is pointed out that this agreement will apply to very few (if any) workers.

Australian Contract

It is reported in *Tenders* (Melbourne) that Sydney County Council has placed the contract for the supply of steam and water feed piping for No. 10 turbo-alternator at Bunnerong power station (Section B) with Babcock & Wilcox, Ltd. The contract price is £16,786, with £1,523 for spare parts.

Economies in Industrial Equipment

The Controller-General of Machine Tools (Ministry of Supply) has written to all manufacturers of industrial electrical equipment urging on them the necessity for economy in man-hours and materials used in the manufacture of electrical equipment.

The Directorate of Industrial Electrical Equipment, a section of the Machine Tool Control in the Ministry of Supply, has recently surveyed the whole field of economy in industrial electrical equipment in collaboration with an advisory panel of the electrical industry. This survey has shown the need for paying special attention to the selection and loading of electrical equipment so that it is used to the limit of its capacity to meet the immediate needs of the war. Practical steps to give effect to this policy have been discussed with the electrical manufacturers, who are collaborating with the Ministry in this matter.

Chief Engineers as "Employers"

Clitheroe Town Council, having considered a letter from the Electrical Power Engineers' Association, has declined to join the North Western District Joint Board of Employers and Members of Staff (Electricity Supply Industry). A resolution has been passed expressing the Council's opinion that a chief electrical engineer of a local authority should not serve on the employers' side of any National or District Joint Council purporting equally to represent employers and employees. Accordingly, permission originally given to the Council's own electrical engineer has been withdrawn.

Calendar

Brookhirst Switchgear, Ltd., Northgate Works, Chester, tells us that refills for its calendar frame are available on request at a charge of 3d. each.

Change of Address

We are informed by Electrical & General Accessories, Ltd., that in future all correspondence should be addressed to their new offices at 7, Newhall Street, Birmingham, 3 (telegraphic address: Elgenic, Birmingham: telephone number, Central 1413).

Training Boys for Industry

FOR some years past W. T. Henley's Telegraph Works Co., Ltd., has encouraged boys in its employ to attend evening classes by granting awards to those achieving examination successes, but little has been done up to the present to organise actual training. During the summer of this year, however, the directors considered means of encouraging the extension of training, and by the time the autumn school courses had started a scheme had been launched.

Meetings of all the boys up to eighteen years of age were held at the works, at which Mr. McArthur and Mr. Judge, works managers, presided. Dr. P. Dunsheath, on behalf of the board, explained the proposals and pointed out the advantages of continued education. Mr. Banner and Mr. Guy, principals of local educational establishments, gave particulars of the facilities and opportunities available and 140 boys signed on for classes.

Under the scheme any boy who can demonstrate his willingness and ability to profit by training is granted one day's leave of absence each week to attend the educational establishment most suitable for his requirements, on the understanding that he will attend classes for at least one evening a week and do the necessary homework. The boy receives his usual wage for the day at school and his class fees are paid by the company. He is also eligible for special prizes authorised by the board.

The basis of the day curriculum is vocational—technical drawing, general science and mathematics. In addition, every boy takes a course in English and, where facilities exist, physical training. This set of subjects is compulsory, but for the evening part of the course a good deal of latitude is permitted to meet the taste of the individual boy. Cultural subjects and hobbies are encouraged and the boys themselves have selected a wide range, including languages, carpentry, book-keeping and lithography. Boys aspiring to higher technical posts in the company aim at a prolonged course, such as that for the National Certificate in Electrical or Mechanical Engineering, and in these cases one evening at least is required for the "serious" subjects in addition to the day course. Many boys are attending more than the prescribed single evening a week, several doing as many as three.

In connection with the scheme a conversazione was held on Saturday last at the Gravesend Technical Institute, which was addressed by Sir Montague Hughman, chairman of the company, who paid a tribute to Dr. P. Dunsheath for his work in connection with the scheme. Dr. Dunsheath gave a lantern talk entitled "Who was Henley?" in which he dealt primarily with the early history of the company. The talk was followed by tea, music, scientific and other demonstrations and competitions, and the presentation of prizes.

INSTITUTION PROCEEDINGS

Central Coal-Blending Plants? Supply Cost Analysis.

Electrification of Collieries

IN a paper entitled "Fuel Economy in Collieries," submitted by Mr. H. E. Partridge to the INSTITUTE OF FUEL in London, consideration is given to the growing use of power-actuated machinery for the mining of coal, raising it to the surface and preparing it for the market,

During the last ten years the percentage increase of power used for coal-cutting has been 110, of electric power installed 25, of electric lamps employed 50, for conveyors 286, for pneumatics 337 and for cleaning 60. While the total amouut of electricity consumed has remained at 6 kWh per ton produced (at a particular pit) the steam used has grown from 145 to 180 lb. and air from 1,200 to 5,600 cu. ft. The author does not see anything fundamentally wrong with power application in these proportions, except that some fuels of the lowest cash value when marketed call for the expenditure of more power and handling than those which command higher prices.

More than 45 per cent. of the total saleable coal produced is now cleaned. To-day there are probably 700 cleaning plants in operation, all adding to the power expended on the preparation of the product.

It is reasonable to suppose that the mechanisation of collieries will continue on an increasing scale, so it is essential to remember that enlargement of the base load reduces the peak load due to winding ; it is the betterment of this load variation which permits the maintenance of more stable conditions.

Proposed "National Fuels"

This is not the time for installing new equipment, however desirable it may be, but that fact does not prevent consideration on broad lines of future possibilities. If more than 2,000 mines are to be remodelled to satisfy changing circumstances, then it appears to be desirable to consider whether better means than those of the past are not available to safeguard the future. The obvious turn is towards the electrification of mines, and to the author there appears to be every reason for believing that national economy can be effected by making more use of the national interlinking grid system. He proposes the assembly of products of many collieries at central blending plants, forming admixtures to which can be added solid by-products from gasworks and coke ovens, the resulting national fuels to be made available to large central power stations.

The provision in this way of more or less "straight-line" fuel, even of a lower calorific value, will enable boiler plant operation to be maintained under reasonably constant fuel bed conditions, so raising efficiency to a higher level. There is hardly an industry in existence that does not blend the ingredients of its products ; thermal waste is inseparable from power generation, but it should be of material which cannot otherwise be usefully employed. Central power stations in which the finest plant is installed should have coal that is best suited to that plant for the lowest possible expenditure in connection with its preparation. Waste of any kind in the provision of something for the payment for which the purchaser has no option must be carefully safeguarded. Too cheap coal has made waste commonplace. In the generation of power electrically by means of steam there is evidence of waste being eventually very largely reduced. The taking over of colliery loads by central electricity stations will occupy many years, but the long view shows it to be more desirable to extend central power stations than to enlarge numerous overloaded collieries.

Tariff Considerations

THE numerous factors that influence the framing of electricity tariffs, mainly for factories, are simply explained in a paper by Mr. J. I. Bernard (E.D.A.) presented before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS. The paper commences with a few statistics indicating that between 1921 and 1939 the total consumption grew from 3,121·7 to 22,537·9 million kWh while the average cost fell from 2·48 to 1·009d. per kWh sold ; in the same period the fuel burned was reduced from 3·2 to 1·4 lb. of coal per kWh generated, or even less, for the Battersea station uses less than 1 lb. and in America the Port Washington station has operated for a year (1940) at an average thermal efficiency of 31·8 per cent. which means 0·85 lb. of coal per kWh.

Capital expended by all electricity supply authorities amounted up to 1938-39 to £179,855,821, or 28 per cent., on generation ; £64,110,995, or 10 per cent., on main transmission, including the grid system ; £315,013,396, or 49 per cent., on distribution ; other expenditure, including apparatus on consumers' premises, the standardisation of frequency, etc., accounting for £89,261,086, or 13 per cent. This capital expenditure is about seven times the annual revenue, whereas most ordinary businesses turn over their capital once or twice a year.

It will thus be seen that a great proportion of the total cost consists of charges that are fixed irrespective of output ; the ratio is illustrated by the fact that of the 1938-39 revenue of £90,131,927 the running costs accounted for little more than £20,000,000.

Overhead charges of this magnitude indicate why the effects of load factor, maximum demand, power factor and the demand assessment period have to be taken into account when framing tariffs, particularly two-part tariffs, with which the greater part of the paper is concerned. Incidentally, the substantial influence that the capital and maintenance charges for low-voltage distribution systems exert upon price of energy is shown by the average price of all supplies at high voltage, which is 0·52d. per kWh compared with 0·8d. at low voltage.

The effects of monthly and half-yearly assessment of the demand period and of the block tariff are illustrated by worked-out factory examples. The general conclusion is that the subject is essentially complex ; whereas costs can be analysed in precise detail, an average price per kWh is meaningless without some statement of the kind of service furnished.

Automatic Diesel Control

THE automatic control of an oil engine power station is described in a paper by Mr. J. S. Muir submitted to the INSTITUTION OF CERTIFICATED ENGINEERS, South Africa, in which the author explains that the extension of railway electrification from Glencoe to Volksrust and the erection of an 88-kV transmission line for supplying the various traction substations have made it desirable to close down the Volksrust power station and to provide a supply from Colenso. The 88-kV lines in Natal are reliable in service, but it is considered advisable, with but a single transmission line from Glencoe to Volksrust, to provide a standby. The retention of the existing power station for standby purposes would have entailed considerable expense so it was decided to dispose of the existing steam plant and install Diesel plant in the same building under full automatic control in order to avoid the expense of standby labour charges.

There are two main sets each consisting of 250-kW, 3,300-V alternators directly coupled to 7-cylinder, 375-HP, 375-RPM Diesel engines. A compressed-air system at 450 lb. per sq. in. is used for starting the engines ; the air chambers are automatically charged by means of two 3-phase 380-V motors. There is also a single-cylinder, 7-HP Diesel engine for use in an extreme emergency to drive one of the two compressors. Fractional HP motors are fitted to each set lubricating system and they are controlled by an electrically operated time switch set to run the motor twice every 24 hours for three minutes at a time, so as to make sure of good lubrication. Lighting is provided from a 60-V battery during emergencies. A low-pressure air chamber at the back of the 3·3-kV feeder switches is used to operate the four oil circuit-breakers.

Both sets will start when failure of the main source of supply persists for more than two minutes. The paper describes the running-up sequence of events and enumerates the faults which cause a set to be locked out of service and give both audible and visible alarms.

The automatic plant has only been called upon once for an emergency run of more than one day since it was put in service ; it then took load for 13 days after the 88-kV line had broken.

Circuit-breaker Operation

The 3·3-kV oil breakers are operated by compressed air. Sometimes they will fail to close once and then continue to function satisfactorily, which makes it extremely difficult to get at the cause of failure. In order to be sure, they are now operated daily as a check ; this also prevents the possibility of a deposit of rust from the condensed moisture in the air jamming the air piston, which would happen with long periods of standing.

The generating sets are also given a fully automatic test run once a fortnight to make sure that all the gear is in order. As the sets have only run a total of 300 hours each since they were first installed the maintenance requirements are correspondingly light. So far the bearings have been checked once and the atomisers cleaned and tested twice. There are two lubricating oil filters and two fuel oil filters so arranged that either may be cleaned without interfering with the running of the plant.

Vacation Apprenticeship Scheme

THE eighth annual report upon the Vacation Apprenticeship Scheme for students of the Imperial College of Science and Technology, covering the year ended October last, states that registrations for works experience in the summer of 1942 numbered 340 (238 were from the City and Guilds College) and it has been necessary to extend the register of firms willing to accept students. There are now 172 of these and from the list reproduced in the report it is seen that they include most of the leading electrical concerns.

There has been an upward trend in the payments made to the students by the firms and the reports received from the firms are consistently satisfactory. During the summer vacation of 1943 (July to September) more than 350 students of the Imperial College will be available for varying periods of from six to eight weeks and it is hoped that the co-operation of industrial concerns will be maintained during the present difficult period.

On-Load Voltage Control

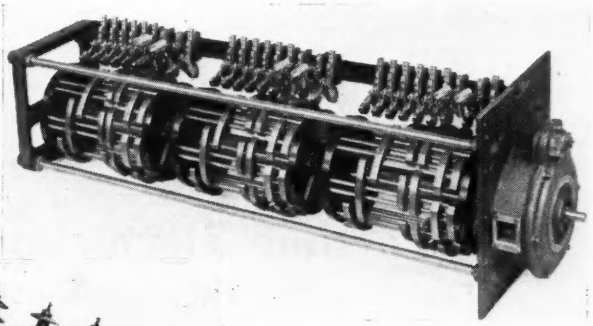
The Employment of Mercury Switches

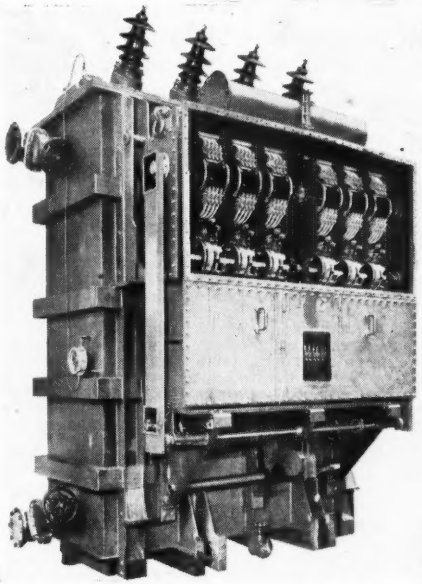
THE possibility of long and arduous duty being imposed on electrical gear in wartime is increased in the case of ratio changers on transformers serving munition works where the shift system goes on continuously right throughout the week, with only the shortest respite at week-ends, allowing insufficient time for even the most cursory inspection of enclosed working parts.

To meet this situation the British Electric Transformer Co., Ltd., introduced four years ago the S.D.A. and a year later the M.D.A. on-load ratio changers, using mercury switches to make and break the circuit. Those types were preceded some three years before by the S.D., which consisted essentially of a horizontal moving drum with fixed fingers, resembling the vertical tramcar controller, operated in oil for arc quenching, insulation, and heat conductivity reasons, providing from 8,000 to 10,000 changes at full load, or more at smaller loads, assuming that two contact positions only were used.

Where the number of changes is limited to some lesser number and the changer is used over a large proportion of the range of steps provided, the S.D. type is still quite a useful piece of equipment.

Similar larger experimental sizes involved increasing the length and diameter of the drum if horizontal, or the use of three drums (one for each phase) mounted vertically ; but in both cases the final outside dimensions were considerably increased and the same limiting features experienced with regard to service requirements necessitated inspection after a similar number of operations. Various types of coupling circuits were tried ; the resistance type demanded that the change should be made quickly and positively, as in the event of sticking with the gear " off " the normal running position, the heat produced by the resistances could not be dissipated by the tank for a long period, except in the small sizes. Thus, it was necessary to include a heavy flywheel, or wound spring, to carry the gear through the change from one step to another independently of the motor once the change had been initiated. Thermal





Above : On-load tap changer fitted with S.D.A.-type mercury switches for up to 11 kV.

Left : Three-phase " ON " transformer, 10,000 kVA, delta-star, 6,300/ 30,500 V, fitted for double M.D.A. on-load tap changing, hand operated

warning devices and trip relays were necessary to safeguard the tap changer in the event of such a failure.

A centre-tapped auto-transformer circuit is generally considered to give the best results under the various operating conditions likely to be met with in general service, and over a large range of loads the voltage variation during change is the smallest. Also, if the range of tap positions required is large, the mid position between taps can be used as a normal running position, which reduces the number of leads to be brought out from the winding for the total range to one half plus one, instead of one lead per tap change position.

The addition of mercury switches to the small drum was made in the S.D.A. type. In this development mercury switches of ample size are mechanically coupled with copper-to-copper contacts and connected to work in parallel, but so arranged that they " break " last and " make " first. Thus, all the arcs are taken by the mercury switches, but because of the use of the centre-tapped auto-transformer circuit they are never called upon to carry the line current alone. By this means maintenance and service of copper contacts is almost entirely cut out, and the oil in the tap-change switchgear is not blackened or damaged in any way.

In the very unlikely event of a mercury switch sustaining damage the tap changer will carry on as a normal S.D. type without loss of continuity, by means of the copper-to-copper contacts. Mercury switches have been tested for life up to millions of operations at the maximum rated voltage and current, with complete success.

The M.D.A. or large drum design developed later uses two horizontal drums, one for the tapping selector and the other for the auto-transformer mercury switches coupled with the copper-to-copper contacts. The latter drum is known as the divertor switch and is coupled to the selector drum by means of a special reduction gear. Sixteen full tap-change positions can be obtained on this gear without using the mid tap position as a normal running position.

The development of this larger gear, added to the range of the small tap changers, gives a complete range of the non-service type from 100 to 10,000 kVA at any voltage up to 33 kV.

Wartime Development

Ruling on New and Additional Supplies

IN April last the Electricity Commissioners indicated that new or additional supplies of electricity should only be afforded in cases where they were clearly shown to be required (*a*) for or in connection with the war effort, or (*b*) for domestic or other purposes where serious and exceptional hardship would result if the supply were not provided.

As a result of the fuel economy campaign, the Commissioners are receiving from electricity undertakers and from prospective and existing consumers inquiries as to whether new or additional supplies of electricity may be afforded, and the necessary materials provided, in a further class of case, namely, where it is clear that by a change-over to the public supply a substantial economy in fuel at present used in other appliances would be effected.

Such inquiries have been in respect, *inter alia*, of cases where cooking could be done more economically by substituting an electric cooker for an obsolete coal range, or where the use of imported oil fuel in cooking or heating appliances or for private electric lighting plants could be obviated and economies effected by a change-over to the public supply of electricity for these purposes.

Labour and Material Considerations

The Commissioners say that while they fully appreciate the importance of all practicable steps being taken to achieve the maximum degree of fuel economy, and to minimise the use of imported oil fuel, these objectives have to be balanced against the availability and cost of the labour and materials involved in the change-over and also against the increasing demands on the public supply systems for electric power for munitions and other war production. On balance, they have come to the conclusion that the latter considerations must prevail and that only the two grounds of justification for new or additional supplies already indicated can be decisive.

Sale of Heating Appliances

The attention of the Commissioners has also been drawn by electricity supply associations and by individual undertakings to the continuing ability of existing consumers to purchase electric heating appliances (especially space-heating appliances) in retail shops; and to the effect of this not only in increasing the electricity consumption of such consumers but also upon the peak loads in winter.

It has been represented to the Commissioners that in present circumstances the purchase of certain types of electrical appliances, including space heaters, should be prohibited, except under licence from the Minister of Fuel and Power. Careful consideration has been given to this suggestion but the Minister of Fuel and Power does not see his way to adopt it owing to a number of administrative and practical difficulties which it would entail. In any case, when existing stocks in retail shops have been used up, the strict control, by licence, of the manufacture of new appliances of this kind which now obtains will substantially reduce the number of such appliances available in future to the public.

ELECTRICITY SUPPLY

Inverness Rural Supplies. Charges at Hackney.

Barrow-in-Furness.—SUPPLY TO COTTAGES.—The Electricity Committee is to provide a supply to Sandscale Cottages at a cost of £452.

Bradford.—TESTING EQUIPMENT.—The Electricity Committee is to install testing equipment at a cost of £164.

Chester.—LOANS SANCTIONED.—Sanction has been obtained by the Electricity Committee to borrow £3,107 for property extensions at a main switching substation, £875 for additional transformers, and £2,525 for a substation.

Inverness-shire.—VILLAGERS WANT ELECTRICITY.—A plea for the provision of electrical installations in houses at Corpach was made by Miss Alison Stewart at a meeting of the County Public Health Committee. She pointed out that householders were limited to half a gallon of paraffin a week and also that the paraffin had to be brought from overseas when they had electric power "at their doors." Provost Donald Cattanach stated that the attitude of the Committee was sympathetic in this matter, and Lochiel said he quite agreed with Miss Stewart.

Gloucester.—REFUNDS OFFSET RENT ARREARS.—The practice by which refunds on electricity meter charges are applied to the reduction of arrears of rents in the case of tenants of Corporation houses was discussed at a recent meeting of the City Council. The Electricity Committee reported that the town clerk had advised them that the system was legal, in view of which it was decided that no alteration was necessary. At the Council meeting the town clerk said that in his view the method was as clear a case of common law right of set-off as could be imagined. An amendment that the minute should not be approved was defeated.

London.—CHARGES AT HACKNEY.—An official notice published in the local Press states that the Council has reluctantly been compelled to consider increasing the scale of electricity charges as from April 1st next. Maximum demand tariff consumers are reminded that their m.d. charge for the year is based on the demands recorded between the beginning of November and the end of February, and any increase will apply to this charge. If any consumer wishes to reduce the m.d. recorded at the date of issue of the notice, application must be made within seven days for the meter to be set at zero.

SOUTHWARK.—The Electricity Committee is considering the provision of an AC supply to Carter Street police station and to other premises.

North Riding.—ROAD LIGHTS.—The County Council is to use electric instead of oil lighting on traffic roundabouts and islands wherever possible.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee proposes to extend the supply in certain streets at a cost of £6,130.

Stockton-on-Tees.—MINIMUM CHARGE.—The Electricity Committee has agreed to alter the 5s. per quarter minimum charge for heating to a yearly minimum rate of £1, in accordance with the recent regulations.

Stretford.—SUBSTATION.—The Stretford and District Electricity Board is to erect a substation.

Sunderland.—ADDITIONAL SUPPLY.—The Electricity Committee has agreed to spend £820 on furnishing an additional electricity supply to an industrial consumer.

West Hartlepool.—REVISED CHARGES.—The Electricity Commissioners and the Ministry of Fuel and Power have approved revised electricity charges drawn up by the Electricity Committee.

Worksop.—STREET LIGHTING.—The Town Council has decided to improve the lighting in the main streets of the town.

Overseas

United States.—PRODUCTION STILL INCREASING.—The Federal Power Commission reports that average daily production of electrical energy for public use in the United States in September reached the record quantity of 4,568·7 million kWh, 1·5 per cent. above the August figure. The month's production was 15,922·9 million kWh, an increase of 12·6 per cent. over the total in September, 1941. Hydraulic plants produced 5,191·7 million kWh.

TRANSPORT

Darlington.—TROLLEY-BUS CONSTRUCTION.—The chassis for the eight trolley-buses to be supplied to Darlington Corporation during 1943-44 are to be built by Karrier Motors, Ltd.

Leeds.—PROBLEM OF ABSENTEEISM.—Commenting on the negotiations for a settlement of the Leeds tramway dispute, which almost resulted in a strike some weeks ago, Mr. W. Vane Morland, general manager, said that many of the troubles would vanish if there was only a partial alleviation of absenteeism. Unfortunately the figures had gone up, and were causing considerable anxiety to the Department which was trying to meet the morning and evening peak demands. Mr. Morland expressed the hope that an improvement in this matter would occur.

Scarborough.—REMOVAL OF TRAM TRACK.—The Corporation's disused tram track is to be taken up and used as scrap.

West Hartlepool.—TROLLEY-BUS APPLICATION REFUSED.—The Regional Transport Commissioner has refused an application by the Corporation for sanction to extend the trolley-bus route from Foggy Furze to the Owton Manor Lane crossroads.

REGRADING OF UNDERTAKING.—The Corporation has agreed to a request by the Transport and General Workers' Union for the transfer of the transport undertaking from Group 3 to Group 1, which will mean wage advances costing the Department £770 per annum.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Perak River Hydro-Electric Power Co., Ltd.—Presiding at the annual meeting on December 16th, Mr. W. Shearer (chairman), said that grave though the position appeared to be when he last addressed shareholders, few would have believed that in less than a month their entire property would have to be abandoned to the enemy by order of our own military authorities. The magnitude of the disaster which overtook Malaya in those fateful days was accentuated in their case as it immediately followed a period in which they had every reason to think that they had reached a considerable measure of stability and prosperity after many years of difficulty and strenuous endeavour.

As to what might be the position of their plant when it was ultimately recovered, it was, of course, impossible to make any forecast. Whatever might be the state in which they found it, they had every reason to expect that they would receive from the Government of Malaya and the British Government all possible facilities for reinstating it, bound up as it was with the key industry of tin production and thus representing a vital link in the chain of trade and commerce which it would be more than ever necessary for governments to encourage on the conclusion of the present conflict.

The Government had issued a statement that it would be its general aim after the war to see that the property damaged in the Colonial Empire should be replaced or repaired to such an extent and over such a period of time as resources permitted, and that if the resources of the Government of Malaya were insufficient to enable this purpose to be achieved without aid, the British Government would be ready to give what assistance it could. The non-committal terms of this statement had been received with some disappointment by those who had suffered substantial losses in the area concerned and powerful representations had been made by the joint committee of various associations trading in the Far East, which they hoped would have the effect of inducing the Government to review the whole matter in order that the extent and priority of its co-operation might be defined in more concrete and satisfactory terms.

Shareholders would realise that in the circumstances no question of any dividend payment could arise until the property was restored and reinstated on an earning basis.

E. K. Cole, Ltd., has announced a dividend of 10 per cent., less tax, on the ordinary capital for the year to September 30th, as compared with 10½ per cent. for the previous eighteen months, equivalent to 7 per cent. per annum.

The General Cable Manufacturing Co., Ltd., is paying a final dividend of 9 per cent., making 15 per cent. for the year (unchanged).

Mann, Egerton & Co., Ltd., announce a net profit of £25,048 for the past year, as compared with £24,821 for 1940-41. The ordinary dividend is 10 per cent. and £2,500 is put to general reserve.

Broom & Wade, Ltd., announce a net profit of £194,833 for the past year (against £176,070). A final ordinary dividend of 15 per cent. maintains the year's distribution at 22½ per cent.

J. & F. Stone (Lighting & Radio, Ltd.), report a profit of £47,445 for the year to June 30th last, against £53,137 for 1940-41. The ordinary dividend is maintained at 5 per cent.

The Electric Furnace Co., Ltd., is again paying an interim dividend of 3½ per cent.

New Companies

Marconi (China), Ltd.—Incorporated in Hong Kong on February 22nd, 1940, and registered in England on November 20, 1942, pursuant to an Order of the Board of Trade. Nominal capital, £50,000 sterling in 50,000 shares of £1 each, of which 20,000 have been issued and fully paid up. Mortgages and charges: Nil. Marconi's Wireless Telegraph Co., Ltd., are the principal shareholders, with 19,995 shares. Directors: Admiral H. W. Grant, C.B., Ridge Cap, Shottermill, Surrey (chairman and managing director of Marconi's Wireless Telegraph Co., Ltd.), Sir E. Wilshaw, K.C.M.G., Arundel House, W.C.2 (chairman and managing director of Cables & Wireless, Ltd.), A. H. Gilman, Montreal (president of the Canadian Marconi Co.) and W. J. Richards, Sydney (managing director of Marconi (China), Ltd.).

Walker (Enfield), Ltd.—Private company. Registered December 9th. Capital, £1,000. Objects: To carry on the business of manufacturers of, dealers in and agents for, plant, machinery, tools, motor, mechanical, electrical and general engineers, garage proprietors, wireless experts, manufacturers of, and dealers in, radio apparatus, etc. The directors are: W. F. Walker, 36, Vicars Close, Enfield, Middlesex, and W. E. Walker, 5, Apple Grove, Enfield, Middlesex.

Artlang Manufacturing Co., Ltd.—Private company. Registered December 2nd. Capital, £1,000. Objects: To carry on the business of electrical engineers and contractors, radio, television, mechanical and general engineers, etc. Subscribers: G. Szarvas and P. S. Szarvas, both of 28, Fryent Way, Kingsbury, N.W.9. Registered office: 42, Langham Street, W.1.

Repetition Welding, Ltd.—Private company. Registered November 28th. Capital, £100. Objects: To carry on the business of welders, welding, electrical and general engineers, etc. Directors: P. S. Taylor and V. G. Taylor, both of Brooklands Cottage, Beeley. Registered office: Brooklands, Beeley, nr. Redditch.

Percivall's Radio, Ltd.—Private company. Registered December 4th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of, and dealers in, wireless and television aerials, apparatus and accessories, gramophones, dictaphones, accumulators, batteries, etc. Subscribers: L. Cohen, 6, Parliament Hill, N.W.3, and M. Tristram, 78, Highgate

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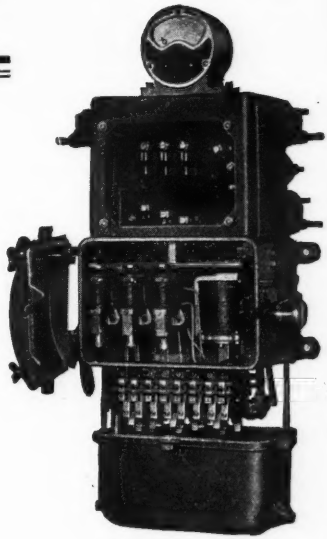

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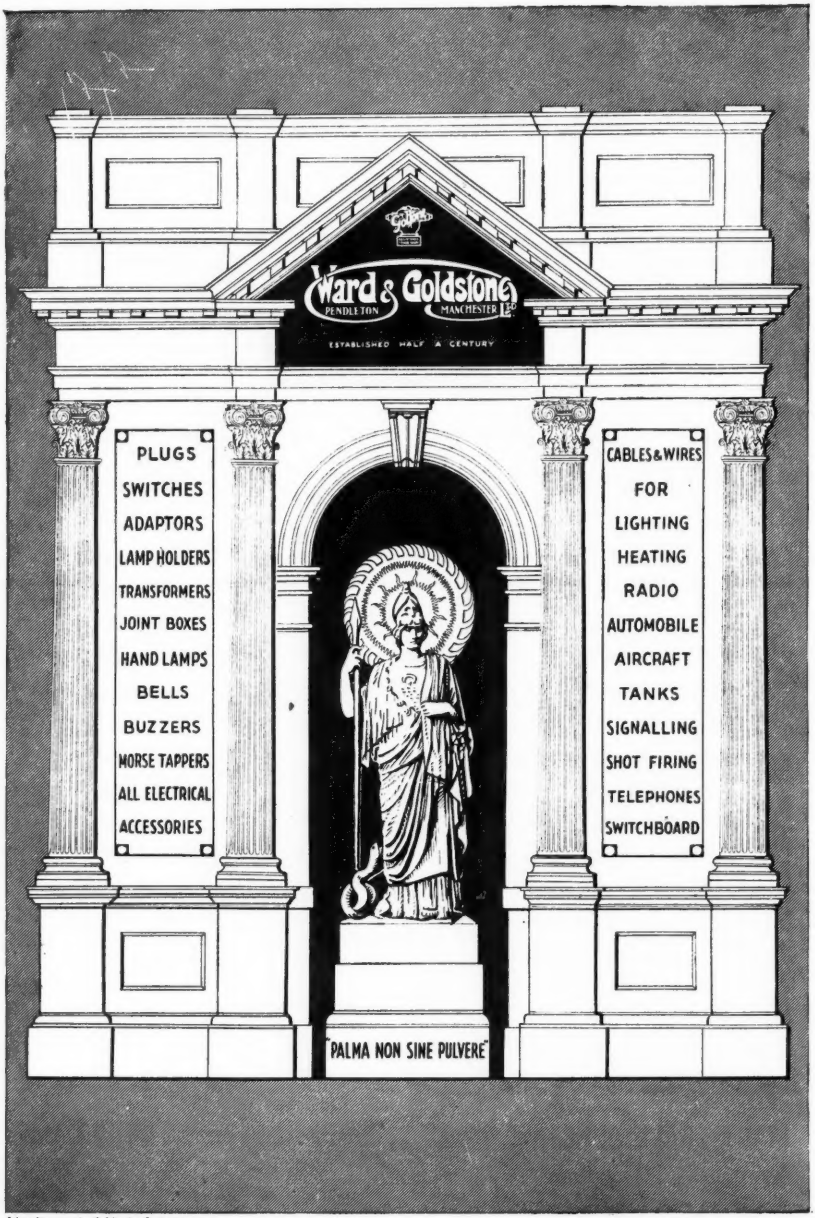

Advertisement of Ward & Goldstone Ltd.

Hill, N.19. Solicitors: Judge, Hackman & Judge, 17, Manchester Square, W.1. Registered office: 4, Approach Road, Gerrards Cross, Bucks.

J. Bull (London), Ltd.—Private company. Registered December 10th. Capital, £100. Objects : To carry on the business of retail and wholesale merchants, manufacturers, factors and repairers of, and agents for, wireless and electrical apparatus and accessories, gramophones, lighting, heating and freezing appliances, etc. Subscribers : D. Harrison, 146, Bishopsgate, E.C., and Doreen Harrison, 154, Main Road, Gidea Park, Essex. Secretary : Doreen Harrison.

Gwent Engineering Co., Ltd.—Private company. Registered December 12th. Capital, £1,000. Objects : To carry on the business of manufacturers, factors, and repairers of, and dealers (on hire-purchase system or otherwise) in, electrical, radio and telephone apparatus, appliances and accessories, machinery, tools, spare parts, etc. Directors : J. W. C. Robinson, and J. W. Kinsman, 45, Cathedral Road, Cardiff.

Companies' Returns

Statements of Capital

Folkestone Electricity Supply Co.,Ltd.—Capital, £237,500 in £1 shares (50,000 5 per cent. cumulative preference, 175,000 ordinary and 12,500 employees co-partnership). Return dated March 31st (filed October 19th). All shares taken up. £200,000 paid. £37,500 considered as paid. Mortgages and charges: Nil.

Lewes & District Electric Supply Co., Ltd.—Capital, £70,000 in £1 shares. Return dated June 18th. 69,000 shares taken up. £57,500 paid. £11,500 considered as paid. Mortgages and charges : Nil.

Venreco, Ltd.—Capital, £16,000 in £1 shares (12,000 6 per cent. preference and 4,000 ordinary). Return dated September 30th. 8,450 preference shares and 4,000 ordinary shares taken up. £8,452 paid. £3,998 considered as paid. Mortgages and charges: £8,500.

Electrolyte, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1941 (filed October 5th, 1942). All shares taken up. £100 paid. Mortgages and charges: Nil.

Bradford Electrical Services, Ltd.—Capital, £5,000 in £1 shares. Return dated September 29th. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Devereux Moodie & Co., Ltd.—Capital, £5,000 in 2,500 preference and 2,500 ordinary shares of £1. Return dated October 9th. 1,900 preference and 1,001 ordinary shares taken up. £2,901 paid. Mortgages and charges: Nil.

Caxton Electric Developments, Ltd.—Capital, £300,000 in £10 shares. Return dated July 3rd. 20,000 shares taken up. £70 paid. £199,930 considered as paid. Mortgages and charges : Nil.

Page & Miles, Ltd.—Capital, £1,500 in 1,000 preference and 500 ordinary shares of £1 each. Return dated July 23rd. 1,000 preference and 250 ordinary shares taken up. £1,250 paid. Mortgages and charges at date of return: Nil. Since registered : Debenture dated September 16th, to secure all moneys due or to become due from the company to Barclays Bank, Ltd., charged on the general assets.

W. E. Dove & Co., Ltd.—Capital, £3,500 in £10 shares. Return dated June 5th. 320 shares taken up. £2,000 paid. £1,200 considered as paid. Mortgages and charges : £3,800.

Horace Grensted, Ltd.—Capital, £2,000 in £1 shares. Return dated July 3rd. 1,500 shares taken up. £1,000 paid. £500 considered as paid. Mortgages and charges : Nil.

Barlow's Weston Electric Lighting Co., Ltd.—Capital, £500 in £1 shares. Return dated June 11th. All shares taken up. £4 paid. £496 considered as paid. Mortgages and charges : Nil.

Sydney R. Hare & Son, Ltd.—Capital, £3,000 in £1 shares. Return dated July 15th. All shares taken up. £3,000 paid. Mortgages and charges : Nil.

Monmouth Electricity Co., Ltd.—Capital, £50,000 in 50,000 ordinary shares of £1 each. Return dated July 27th. 35,000 shares taken up. £35,000 paid. Mortgages and charges: Nil.

Settle & District Electricity Co., Ltd.—Capital, £100,000 in 100,000 shares of £1 each. Return dated July 20th. 75,000 shares taken up. £75,000 paid. Mortgages and charges: Nil.

Alfred G. Mason & Collins, Ltd.—Capital, £2,000 in 2,000 shares of £1 each. Return dated September 18th. All shares taken up. £2,000 paid. Mortgages and charges: Nil.

Mortgages and Charges

Britannic Electric Cable & Construction Co., Ltd.—Further debenture, charged on the company's undertaking and property, including uncalled and unpaid capital, dated November 26th, 1942, to secure £25,000 (supplemental to debentures dated June 28th, 1938, October 11th, 1939, May 15th, 1940 and October 20th, 1941). Holders: Westminster Bank, Ltd.

Hale Electrical Co., Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 27th, 1942, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Winding-up Order Refused

Vibro Insulations, Ltd.—In the Companies Court, Chancery Division, on December 14th, Mr. Justice Simonds, dismissed a petition for the compulsory winding-up of this company. It was stated that the company had passed a resolution for voluntary liquidation.

Bankruptcies

D. G. Lee, electrician, 240b, Clapham Road, London, S.W.9.—This debtor attended the London Bankruptcy Court on December 18th for his public examination. He stated that his liabilities amounted to £595, and his assets to £2. He started business in January, 1939, but the following month a limited company was formed to which the business was transferred. In July, 1939, debtor left the concern. He attributed his failure to liability for costs in an unsuccessful action brought against a late partner. The examination was closed.

STOCKS AND SHARES

TUESDAY EVENING.

CHRISTMAS week is not noted for contributing much in the way of grist to Stock Exchange mills. Too many other matters occupy the public mind for people to take an active interest in securities. The news from the North African and the Russian war fronts is read as being decidedly cheerful. This being so, it is not difficult to understand the underlying strength of prices in the Stock Exchange markets where, although business has fallen away to a great extent, quotations keep firm. This suggests that after the turn of the New Year, when money becomes more fluid, there will be a fresh movement on the part of investment towards absorbing whatever supplies may be on offer in the various departments of the Stock Exchange.

Home Rails Hesitant

Early reactions in the Home Railway market were favourable to the increases of wages granted to railway employees. The advance was rather less than had been expected and can easily be met out of the earnings of the companies under war conditions. It will make no difference to whatever dividend policy the directors have probably decided upon already. The settlement will remove, at all events for a time, the uneasiness produced by constant suggestions that wages ought to be put up in order to cover increased living costs. Upon such, and similar considerations, prices improved, the junior stocks being more particularly wanted. However, the market lacked staying power, which, in this case, is another way of saying public support. Southern preferred went back to 74½; Transport " C " is a dull market at 55, in spite of optimism that the dividend may be raised by half a crown, and put up to 3 per cent. Prior-charge issues are steady.

Radio Shares

Amongst the few features of the past week, " Emmies " are conspicuous with a gain of 1/16 to 19s. Men in the market confessed that they could see no adequate reason for the rise. At 17s. 9d., the previous week's price, " Emmies " looked high enough on the last dividend of 6 per cent. This gave a yield of less than 3¼ per cent., and offered temptation to selling a bear of the shares. Some people apparently did. Their efforts to apologise—by repurchase of the shares—added to the effect produced by a demand for a few thousand shares. Rumour toyed with various explanations, not sufficiently authentic to warrant repetition here. The shares seem very fully valued in the light of present published information.

On the increase in the dividend from 7 per cent. last year, to 10 per cent. in respect of 1941-42, E. K. Cole shares hardened a trifle. Previously, the price was standing at 14s. 3d., which, on the 7 per cent. dividend basis, seemed to discount the advance in the distribution that has just been declared. Even on the 10 per cent. dividend, the 5s. shares look tolerably high at their current figure ; after all, a yield of £3 9s. per cent. is none too generous. Post-war prospects, as in the case of Electric and Musical Industries, are sufficiently promising to confirm shareholders in their intention to retain their interests.

Automatic Telephone

The Automatic Telephone shares quoted in our weekly price-lists are, it may be of service to mention, the " A " ordinary, as distinct from the " B " deferred shares. Both are of £1 each, and both receive the same dividend; that is 12½ per cent. The Stock Exchange market in the shares is mainly in the " A " ordinary; these stand about 3s. higher than the " B " because they have the right to a prior 6 per cent. dividend before the deferred shares receive anything. First comes the 6 per cent. dividend for the ordinary shares; after that, the deferred rank equally up to 6 per cent. Further profits are divided between the two classes. The " A " deferred, of which there are 100,000 in £1 shares, are all held by British Insulated Cables, Ltd.

Argentine Trams

Anglo-Argentine Tramways issues and City of Buenos Ayres Trams have spurted upon circulation of an interesting rumour to the effect that the Argentine Government may take over the systems, and pay handsome compensation. The companies are controlled by the Buenos Aires Transport Corporation, which corresponds, roughly, to our own London Passenger Transport Board. The Argentine Government is said to be negotiating with the B.A. Transport for acquisition of the Board's holdings, and lively interest awaits some official announcement on the subject.

Price Fluctuations

British Insulated, with a fall of 1s. and Murex, having gained 1/16, met at the common price of £5. Both companies pay 20 per cent. dividends, giving 4 per cent. yield on the shares. The buying of Murex persisted, and the price rose further to 5 1/16. Callender's have lost 6d., easing off to 75s. 6d. Here the return is £3 19s. 7d., while Henley's, which are 3d. down at 23s. 6d., give to-day's buyer 4¼ per cent. Electric Constructions rose 1s. 6d. to 39s., and British Aluminium 9d. to 49s. Mather & Platt at 46s. 3d. have put on 6d. Associated Electricals continue in demand, and are a little firmer at 48s. Stone

(*Continued on page* 834)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Dec. 22	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	57/6	+1/-	4 7 0
British Power and Light	6	6	29/-	+1/-	4 2 0
City of London	7	7	31/6	..	4 9 0
Clyde Valley	8	8	40/6	..	3 19 0
County of London	8	8	39/6	−6d.	4 1 0
Edmundson's:					
7% Pref.	7	7	31/-	..	4 2 4
Ord.	6	6	28/-	..	4 5 9
Elec. Dis. Yorkshire	9	9	43/6	+6d.	4 3 9
Elec. Fin. and Securities	12½	12½	49/-	..	5 2 1
Elec. Supply Corporation	10	10	46/-	..	4 7 0
Isle of Thanet	2	Nil	15/6	..	—
Lancs. Light and Power	7½	7½	35/6	..	4 4 6
Llanelly Elec.	5½	5½	22/6	..	4 17 9
Lond. Assoc. Electric	4½	4	23/-	−6d.	3 9 7
London Electric	6	6	27/6	..	4 7 3
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	40/6	..	3 19 0
Midland Counties	8	8	40/-	..	4 0 0
Mid. Elec. Power	9	9	43/6	..	4 4 9
Newcastle Elec.	7	7	30/-	..	4 13 5
North Eastern Elec. Ordinary	7	7	32/6	..	4 6 4
7% Pref.	7	7	33/6	..	4 3 7
Northampton	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10)	6	Nil	8½	..	—
Northmet Power: Ordinary	7	7	38/-	..	3 13 8
6% Pref.	6	6	30/-	..	4 0 0
Richmond Elec.	6	6	25/-	..	—
Scottish Power	8	8	40/-	..	4 0 0
Southern Areas	5	5	22/6	..	4 9 0
South London	7	7	26/-	..	—
West Devon	5	5	22/6	..	4 9 0
West Glos.	4½	3½	21/6	..	3 5 2
Yorkshire Elec.	8	8	41/-	..	3 18 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/9	−3d.	—
Calcutta Elec.	7*	7*	31/6	..	—
Cawnpore Elec.	10	10	27/-	..	7 8 2
East African Power	7	7	29/6	..	4 15 0
Jerusalem Elec.	7	5	23/6	+6d.	4 5 0
Kalgoorlie (10/-)	7½	5	9/6	..	5 5 3
Madras Elec.	6*	4*	21/6	..	—
Montreal Power	1½	1½	26½	..	5 13 2
Palestine Elec. "A"	Nil	4*	31/6	−6d.	2 10 9
Perak Hydro-elec.	6	7	9/6	−1/-	—
Shawinigan Power	83cts.	90cts.	18	−½	—
Tokyo Elec. 6%	6	6	21½	+½	—
Victoria Falls Power	15	15	80/-	..	3 15 0
Whitehall Inv. Pref.	5	5	20/-	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price Dec. 22	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence)	—	3	99½	..	3 0 4
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	102	..	3 8 8
1974–94	3½	3½	99	..	3 5 4
London Elec. Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955-75	4½	4½	109	..	4 2 7
Lond. Pass. Trans.:					
A	4½	4½	117½	..	3 16 7
B	5	5	116½	..	4 5 10
C	3	2½	55	..	5 4 8
West Midlands J.E.A. 1948–68	5	5	109	..	4 11 7
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	109½	−1	5 9 7
Def.	1½	1½	27	..	5 11 1
Anglo-Portuguese	8	8	23/-	..	6 19 4
Cable & Wireless:					
5½ Pref.	5½	5½	107	+½	5 2 10
Ord.	4	4	75	−1	5 6 8
Canadian Marconi $1	Nil	4cts.	5/6	..	2 17 6
Globe Tel. & Tel.:					
Ord.	8½*	5*	32/-	..	3 2 6
Pref.	6	6	27/-	−6d.	4 9 0
Great Northern Tel.: (£10)	Nil	Nil	23	..	—
Inter. Tel. & Tel.	Nil	Nil	7	−½	—
Marconi-Marine	7½	7½	31/6	..	4 15 3
Oriental Tel. Ord.	16	10	57/6	..	5 9 8
Telephone Props.	6	Nil	13/3	..	—
Tele. Rentals (5/-)	10	10	10/-	..	5 0 0
Traction and Transport					
Anglo Arg. Trans.:					
First Pref. (£5)	Nil	Nil	4/-	..	—
4% Inc.	Nil	Nil	13	+2	—
Brit. Elec. Traction:					
Def. Ord.	45	45	1015	..	4 8 8
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8	10	47/3	..	4 4 6
Brazil Traction	$\frac{1}{3}$	$1	20½	+1½	—
Calcutta Trams	8	5½	19/-	..	5 15 9
Cape Elec. Trams	5	5	23/-	..	4 7 0
Lancs Transport	10	10	43/3	..	4 12 4
Mexican Light:					
1st Bonds	5	5	93½	..	5 7 0
Rio 5% Bonds	5	5	101½	..	4 18 6
Southern Rly.:					
5% Prefd.	5	5	74½	−½	6 14 4
5% Pref.	5	5	110	..	4 11 0
T. Tilling	10	10	50/-	..	4 0 0
West Riding	10	10	37/6	..	5 6 8

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Dec. 22	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	7½	10	33/6	..	5 19 4
Assoc. Elec. :					
Ord.	10	10	48/-	+6d.	4 3 4
Pref.	8	8	39/-	..	4 2 0
AutomaticTel.&El.	12½	12½	53/-	..	4 14 4
Babcock & Wilcox	11	11	48/6	+1/-	4 10 7
British Aluminium	10	10	49/-	+9d.	4 1 8
British Insul. Ord.	20	20	5	−1/-	4 0 0
British Thermostat (5/-)	18½	18½	16/6	..	5 12 1
British Vac. Cleaner (5/-)	10	15	20/6	..	3 13 2
Brush Ord. (5/-) ..	Nil	6	6/6	..	4 12 4
Callender's ..	15	15	75/6	−6d.	3 19 7
ChlorideElec.Storage	15	15	76/3	..	3 18 9
Cole, E. K. (5/-) ..	7	10	14/6	..	3 9 0
Consolidated Signal	17	17	95/-	..	3 11 9
Crabtree (10/-) ..	17½	17½	36/-	..	4 17 3
Crompton Parkinson Ord. (5/-) ..	30	20	24/-xd+3d.		4 3 4
E.M.I. (10/-) ..	6	6	19/-	+⅛	3 3 2
Elec. Construction	10	10	39/-	+1/6	5 2 8
Enfield Cable Ord.	12½	12½	58/6	..	4 5 7
Elecl. Switchgear (10/-)	10	10	20/-	..	5 0 0
English Electric ..	10	10	45/-	..	4 9 0
Ensign Lamps(5/-)	25	25	17/6	..	7 2 10
Ericsson Tel. (5/-)	22*	20*	43/9	..	2 5 9
Ever Ready (5/-)	40	40	35/6	..	5 12 8
Falk Stadelmann	7½	7½	26/-	..	5 15 5
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C. :					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	20	17½	86/-	..	4 1 5
Greenwood & Batley	15	15	35/-	..	8 11 6
HallTelephone(10/-)	10	12½	22/9	..	5 10 0
Henley's (5/-) ..	20	20	23/6	−3d.	4 5 2
4½% Pref. ..	4½	4½	23/-	..	3 18 3
Hopkinsons ..	15	15	55/-	+6d.	5 9 0
India Rubber Pref.	5½	5½	20/-	..	5 10 0
Intl. Combustion	32½	30	6	..	5 0 0
Johnson & Phillips	15	15	63/-	..	4 15 4
Lancashire Dynamo	20	20	76/6	..	5 4 8
Laurence,Scott(5/-)	15	12½	10/-	..	6 5 0
London Elec. Wire	7½	7½	30/-	..	5 0 0
Lucas, J.	15	15	71/3	..	4 4 0
Mather & Platt ..	10	10	46/3	+6d.	4 6 7
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5	+⅛	3 19 0
Pye Deferred (5/-)	25	25	19/6	..	6 8 2
Revo (10/-) ..	20	17½	34/6	..	5 1 5
Reyrolle	12½	12½	62/-	..	4 0 7
Siemens Ord. ..	7½	7½	28/-	..	5 7 2
Smith, S. (1/-) ..	50	37½	9/-	..	4 3 4
Strand Elec. (5/-)	4	7½	5/6	..	6 16 4
Switchgear & Cowans (5/-) ..	15	10	12/6	..	4 0 0
T.C.C. (10/-) ..	5	5	15/-	..	3 6 8
T.C. & M... ..	10	10	46/-	..	4 7 0
Telephone Mfg.(5/-)	9	9	11/-	..	4 1 10
Thorn Elec. (5/-)	20	20	19/6	+3d.	5 2 7
Tube Investments	23⅓	20	89/6	..	4 9 3
Vactric (5/-) ..	Nil	Nil	8/9	−3d.	—
Vickers (10/-) ..	10	10	18/-	..	5 11 1
Ward & Goldstone (5/-)	20	20	20/6	..	4 17 7
Westinghouse Brake	10	10	57/6	..	3 9 5
Walsall Conduits(4/-)	55	55	41/3	..	5 6 6
West, Allen (5/-)	7½	7½	6/6	..	5 15 5

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 832)

Lighting & Radio are better at 4s. 6d. The electricity supply group shows no great change in prices. Bournemouth & Poole are 1s. up at 57s. 6d.; the shares of the parent company, County of London, are 6d. off at 39s. 6d. West Kent 4½ per cent. preference at 22s. are 6d. lower. The report upon Scottish hydro-electric power has had no effect upon the prices of the Scottish electricity supply companies.

Among the shares of overseas companies Perak River Hydro-Electric weakened to 9s. 6d. upon the Government's statement that no definite terms can be yet laid down in connection with war damage suffered by tin and rubber companies in the Middle East. Tokyo Electric sixes at 21½ are 10s. harder. Shawinigan Power shares have gone back a trifle to 18.

Miscellaneous Matters

Cable & Wireless preference rose ½ to 107, while the ordinary slipped back to 75. Anglo-American Telegraph preferred weakened to 109. International " Tel & Tel " shares are back to 7. Telephone Properties hold their advance to 13s. 3d. Now that the company is about to clear off all dividend arrears on its preference shares, the view is expressed that the ordinary have come once more into sight of a distribution. Indeed, a 6 per cent. dividend a year hence is already prophesied as probable. Globe preference are 6d. down at 27s. Atlas lost another 3d. at 4s. 9d. A spurt in Brazilian Traction lifted the price 1¼ to 20¼; there is some talk of the dividend being increased fairly soon. The greater part of the support seemed to come from across the Atlantic.

Paper Economy

The new drive for salvage in the direction of obtaining fresh supplies of paper for war purposes, lends interest to the report and accounts of Crompton Parkinson & Co. These are published in so modest a form as almost to require the use of a glass by those whose eyesight is not so good as it used to be. The format is in strict contrast to reports from certain other companies whose anxiety to economise in the matter of paper is by no means marked. Crompton Parkinsons have set an example of the manner in which a good deal of very satisfactory information to shareholders can be conveyed in a small space.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

1939

26825. "Thermionic valve circuits." Telefonaktiebolaget L. M. Ericsson. October 26th, 1938. (549484.)

29251. "Electric forging apparatus." E. Gaspar and Omes, Ltd. November 2nd, 1939. (549569.)

1940

6699. "Electrical discharge devices, and process of making the same." A. H. Stevens (Firestone Tire & Rubber Co.). April 12th, 1940. (Convention date not granted.) (549486.)

10827. "Leakage indicators for alternating electric current circuits." Westinghouse Brake & Signal Co., Ltd., S. A. Stevens and L. H. Peter. June 24th, 1940. (549511.)

15504. "Electrodes and other metal parts of electro-discharge devices." Hygrade Sylvania Corporation. December 8th, 1939. (549485.)

1941

3798. "Production of synthetic resins from furfuryl alcohol." British Thomson-Houston Co., Ltd. March 26th, 1940. (549515.)

3948. "Electrical means for testing the balance of rotating masses." Scophony, Ltd., and G. Wikkenhauser. March 24th, 1941. (549548.)

4663. "Telephone systems." Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker. April 8th, 1941. (549488.)

5044. "Rotary electric convertors." B. Schwarz. April 18th, 1941. (549490.)

5279. "Meteorological apparatus." Ferranti, Ltd., M. K. Taylor and I. N. Vaughan-Jones. April 24th, 1941. (549549.)

5715. "Microphones." Standard Telephones & Cables, Ltd., and J. S. P. Roberton. May 2nd, 1941. (549518.)

6410. "Electric elevator systems." G. R. Shepherd (Westinghouse Electric International Co.). May 19th, 1941. (549495.)

6541. "Electric fuses." H. Astbury and Crompton Parkinson, Ltd. May 21st, 1941. (549578.)

6546. "Electromagnetic clutches." Lear Avia, Inc. July 20th, 1940. (549552.)

6629. "Automatic electric circuit-breakers." Westinghouse Electric International Co. June 8th, 1940. (549554.)

6634. "Calculating apparatus." Standard Telephones & Cables, Ltd. (Bell Telephone Manufacturing Co.). May 23rd, 1941. (549533.)

6703. "Combined electric motor, clutch and brake unit." W. C. Fairweather (Singer Manufacturing Co.). May 26th, 1941. (549605.)

6750. "Induction regulators and their application to the control of alternating current commutator motors." B. Schwarz. May 26th, 1941. (Cognate applications, 2960/42 and 3168/42.) (549536.)

7080. "Means for converting a direct voltage into a frequency proportional thereto." W. W. Triggs (Akt.-Ges. Brown, Boveri & Cie.). June 4th, 1941. (Addition to 548396.) (549614.)

7641. "Moving stairways." Westinghouse Electric International Co. June 18th, 1940. (549616.)

8106. "Variable frequency oscillator with mechanical volume equaliser." Standard Telephones & Cables, Ltd. July 3rd, 1940. (549537.)

8378. "Electrical heating devices or appliances." C. L. Grimwood. July 3rd, 1941. (549617.)

9605. "Arc shields." British Thomson-Houston Co., Ltd. August 1st, 1940. (549540.)

10270. "Electrical oscillators comprising thermionic valves." General Electric Co., Ltd., L. I. Farren and R. S. Rivlin. August 13th, 1941. (549499.)

10282. "Electric protective arrangements of the earth-leakage type." British Thomson-Houston Co., Ltd., H. Trencham and J. R. Mortlock. August 13th, 1941. (549500.)

10589. "Magnetic gearing." British Thomson-Houston Co., Ltd. August 21st, 1940. (549590.)

10735. "Manufacture of electric insulating materials." O. Silberrad. August 22nd, 1941. (549561.)

10806. "Apparatus for generating electric current for lighting and driving machinery." J. N. Waite. April 20th, 1942. (549562.)

11599. "Manufacture of dynamo-electric machines." English Electric Co., Ltd., and L. Roberts. September 10th, 1941. (549503.)

11697. "Piezo-electric crystal apparatus." Standard Telephones & Cables, Ltd. September 20th, 1940. (549594.)

11962. "Gas-blast electric circuit-breakers." British Thomson-Houston Co., Ltd., and H. E. Cox. September 18th, 1941. (549595.)

12493. "Coupling arrangement for power line carrier telephone systems." Standard Telephones & Cables, Ltd. October 5th, 1940. (Cognate application, 12494/41.) (549623.)

13909. "Electric transformers." British Thomson-Houston Co., Ltd. October 31st, 1940. (549567.)

15452. "Control systems for stage lighting and the like." Igranic Electric Co., Ltd. December 7th, 1940. (549628.)

15474. "Centrifugal machines." Electric Household Utilities Corporation. March 1st, 1941. (549629.)

1942

3127. "Elastic fluid turbine bucket wheels." British Thomson-Houston Co., Ltd. March 13th, 1941. (549509.)

7572. "Telephone systems." Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker. April 8th, 1941. (Divided out of 549488.) (549510.)

Amended Specification

516408. "Automatic or semi-automatic telephone systems." J. E. Pollak.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birkenhead.—January 11th, Electricity Dept. Switchgear and transformers. (See this issue.)

Manchester.—January 5th. Electricity Department. Two electrically driven capstans and four bollards. (December 11th.)

Orders Placed

Australia. — MELBOURNE. — City Council. Accepted. Eight 3-pole vertical-type overcurrent relays, two 3-pole vertical-type earth-leakage relays and twelve 3-pole horizontal-type overcurrent relays (£678 approx.).—A. Reyrolle & Co., Ltd.

COMMONWEALTH.—Department of Supply and Development. Accepted. Lamp globes (£418). —British General Electric Co.

Postmaster-General's Department. Accepted. Mechanically operated spring sets, 2,000-type switch (£367 plus exchange).—Automatic Electric Co. (A/sia) Pty., Ltd. Accumulator cells, open type (£2,113).—Exide Batteries of Australia Pty., Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bacup.—Houses ; H. Guffogg, borough surveyor.

Chester.—Offices, etc., Boughton; Chester Engineering Co., Ltd.

Coventry.—Buildings for Senior School for 480 pupils at Keresley; D. E. E. Gibson, city architect, 1a, Warwick Row, Coventry.

Darlington.—Bakery, Durham Road, for J. Tidyman.

Eccles.—Installation of new humus sludge pumps in sewage disposal works; T. Elce, borough engineer, Town Hall, Liverpool Road.

Hertfordshire.—Temporary accommodation at Russell Lane School, East Barnet ; Clerk's Department, Castle Street, Hertford.

Hull.—Evening play centres (£5,063) ; A. Rankine, city architect.

Hulme.—Works additions ; McCutcheon & Walsingham, architects, 1180a, Chester Road, Stretford.

Kent.—Nurseries at North Cray ; county architect, Maidstone.

Kilmarnock. — Decontamination and ambulance station (£3,300) ; manager, Glenfield & Kennedy, Ltd.

Leigh.—British Restaurant (£3,211); T. A. Clare, borough surveyor.

Pumping station for South Lancashire Rivers Catchment Board; R. W. Eaton, engineer, Central Buildings, North John Street, Liverpool, 2.

London.—L.C.C.—Kitchens (£6,000); county architect, County Hall.

BERMONDSEY.—Three hutted nurseries ; borough surveyor, Municipal Offices, Spa Road, S.E.16.

CAMBERWELL.—Nurseries (£3,000); J. W. Ashdown, Ltd.

Manchester.—Works extensions ; Robinson & Kershaw, constructional engineers, 22, Temple Street, Chorlton-on-Medlock.

Middlesex.—Hospital additions, Hillingdon (£5,000) ; county architect.

Nottinghamshire. — Workshop, Sherwood Village Settlement, Mansfield ; E. W. Roberts, county architect, Trent Bridge, Nottingham.

Oxford.—Office, etc.; Pressed Steel Co., Ltd. Offices and workshop, Cowley; Morris Motors, Ltd.

Peterborough.—Canteen building at electricity works (£2,000); A. J. Reeves, town clerk, Town Hall.

Reddish.—Works extensions ; Kay Bros., adhesive makers, Kayborough Works.

Sheffield.—Completion of houses ; W. G. Davies, city architect.

Stockport.—Building works for electricity committee ; L. G. Mouchel & Partners, consulting engineers.

Stockton-on-Tees. — Additions to school kitchen, and wartime nursery, Durham Road; borough engineer.

Swaffham. — Houses at Ashill ; A. S. Robinson, housing officer, Council Offices, Market Place.

Swansea.—Additions, wagon works, South Dock Basin; J. Pridmore.

Swinton and Pendlebury.—Installation of new washing machinery in public baths; A. Cordwell, borough surveyor, Town Hall.

Warrington.—New offices ; Crosville Motor Services, Ltd., Chester (R. C. Cowmeadow, resident architect).

Canteen, offices and stores, Winwick Road; H. Diaper & Co., warehouse owners, King Edward Street, Liverpool, 3.

West Hartlepool.—Nursery at Dyke House ; T. A. Young, builder, Hart Station.

Erection of huts at Howbeck Institution (£1,700), and British Restaurants in Pease Street and York Road; borough engineer.

Wigan.—Additional school feeding centres ; borough engineer.

Willesden.—Hutted day nurseries at Conley, Hawthorn and Crest Roads ; borough engineer, Town Hall, Dyne Road, N.W.6.

Wolverhampton.—Extensions, 78, Birmingham Road ; C. P. Dawes.

For EMERGENCY LIGHTING
BATTERY CHARGING
MAGNETIC APPLICATIONS
ELECTRO-PLATING
SIGNAL CONTROL
LABORATORIES
A.R.P. SHELTERS
ETC.
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HEAYBERD RECTIFYING EQUIPMENT
List 1029 describes and illustrates many of the above uses and gives technical data on Metal and Valve Rectifiers. This list is available on application.
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MALLORY 73

BERYLLIUM COPPER

for Current-carrying springs • Snap action switch blades • Contact blades and clips • Instrument springs, diaphragms and bellows

GREATER tensile, elastic and fatigue strengths than any other non-ferrous alloy, a higher conductivity than any of the bronzes and excellent resistance to corrosion and wear—these characteristics of Mallory 73 Beryllium Copper have made it first choice for heavy-duty electrical and instrument springs.

Supplied annealed or lightly cold worked, it has good forming properties and is readily fabricated into springs and parts of complicated shape. A simple heat treatment then develops its remarkable properties.

Available as sheet, strip and wire, in a range of tempers to suit users' requirements, and as rod, tube, precision rolled hairspring strip, and silver-faced contact bi-metal strip.

Properties of MALLORY 73 BERYLLIUM COPPER after Heat Treatment	
Ultimate tensile stress, *tons per sq. inch*	**75 - 90**
Limit of proportionality, *tons per sq. inch*	**45 - 50**
Fatigue limit, *tons per sq. inch*	**±20 - 22**
Vickers pyramid hardness,	**350 - 420**
Electrical conductivity, *per cent. I.A.C.S.*	**25 - 30**

Full details are given in our booklet which will be sent on request

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MALLORY METALLURGICAL PRODUCTS LTD.
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(An Associate Company of ***Johnson Matthey & Co. Ltd.****)*
Telephone : HOLborn 6989

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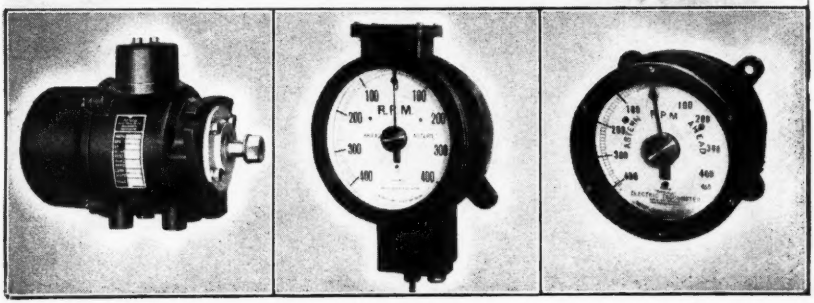
ROBUST ACCURATE & RELIABLE

RECORD

'CIRSCALE' Electric type TACHOMETERS



D.C. GENERATOR TRANSMITTER made in two types. Industrial and Watertight as required. Two or more indicators can be operated from the one Transmitter.

MARINE PATTERN INDICATOR in Admiralty bronze watertight case with terminal box and fixing lugs. Illuminated dial also supplied, for use on the bridge of a ship.

MARINE PATTERN INDICATOR in dust and splash proof case, for wall or panel mounting. Illustration shows centre zero instrument for use as combined directional and speed indicator.

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Cable Works: WEMBLEY, MIDDLESEX.

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Electric Control Gear

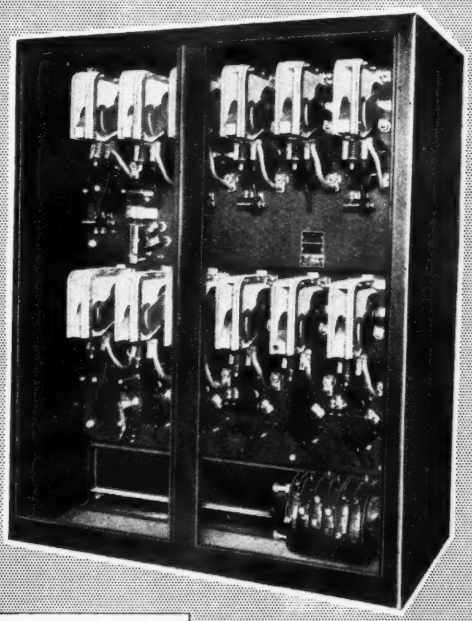

Illustration shows Igranic Panel for Control of 25-Ton High-Speed Main Hoist Dogging Crane

BEDFORD
IGRANIC
ELECTRIC Co LTD
LONDON

For
EFFICIENT PROTECTION
of Valuable Machinery and for
RELIABILITY specify
IGRANIC CONTROL
A TYPE FOR EVERY DUTY AND SERVICE

METALLIC SEAMLESS TUBE COMPANY LIMITED
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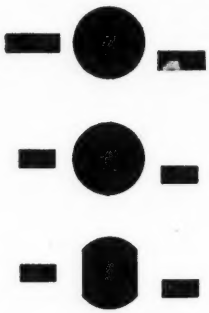
LOOK FOR THE **A.S.C.M** MARK ON EVERY LENGTH

This is the System that Wylex Built

3 SOCKETS
15 amp. 5 amp. and 2 amp.

3 PLUG TOPS
15 amp. which will take the 5 or 2 amp. Fused Plugs.

The Apertures in Sockets and the Plug Pins vary in width.



THEREFORE small plugs go into LARGER SOCKETS while larger Plugs will not go into SMALLER SOCKETS.

This gives exceptional convenience.

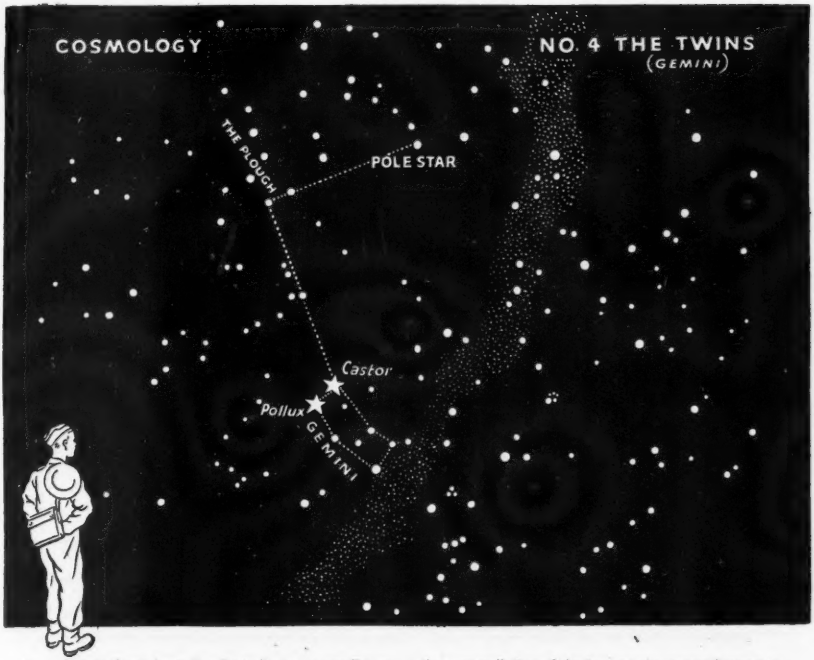
Can only be done with the Flat Pin Wylex Fuse Plug System.

WYLEX

MILLIONS IN USE

GEORGE H. SCHOLES & Co. Ltd.
Wylex Works, Wythenshawe, MANCHESTER.

N5



Gemini (Latin for "The Twins") is a constellation containing the two bright stars Castor and Pollux, which often become visible much earlier in the evening than the remaining stars of this constellation. In the above map it will be seen that Gemini lies on a line approximately at right angles to that drawn from the "pointers" of the Plough to the Polestar, and is close to the Milky Way.

Castor and Pollux begin to appear about 10 to 11 p.m. rather low down on the eastern horizon on any clear October evening. In the succeeding months they come into view earlier and earlier until at the end of December they are well clear of the haze on the eastern horizon by 9 p.m., and at that time in early March they will have attained their highest point, lying due south of the Polestar. By June they have almost reached the western horizon before sunset and during the evenings of July, August and September they lie below the northern horizon.

Constellations which have been featured previously in this series of advertisements are Orion and Cassiopeia. You will find it an interesting and useful exercise to see if you can "spot" them on the above map.

COSMOS
AND
METROVICK
LAMPS
Metrovick's 'light' product

THE BATTLE FOR FUEL
USE LESS LIGHT
but USE IT WELL

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.
NUMBER ONE KINGSWAY, LONDON, W.C.2

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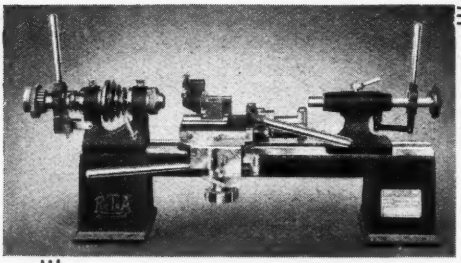

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CENTRE HEIGHT 50 mm.
SPINDLE BORE 8 mm.

Speed range 400 r.p.m. to 6,000 r.p.m. for motorised model

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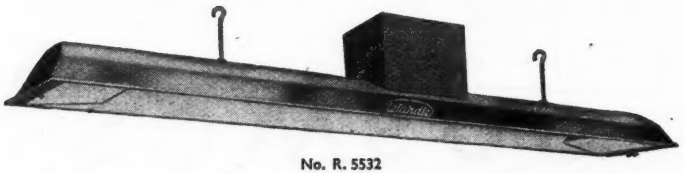

No. R. 5532

For use with 80-watt, 5-ft. Fluorescent Tubes.
Heavy gauge sheet steel. Standard finish, glossy enamel.
Chain or tube suspension. With or without gear box..

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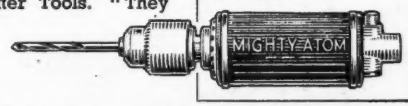
LETTER FROM SATISFIED CUSTOMER:

"Having used a number of different makes it beats me why Desoutter Tools are not universally used. Can you explain this mystery?"

Well, yes, Sir, as a matter of fact we *can*, but you mustn't repeat it or we shall get in bad with engineers who are, of course, our customers. The fact is that engineers (ourselves included) always pretend that they buy on *"technical facts alone." Salesmanship—boo! boo!!* But acksherly, of course, us engineers are very much like human beings. We like a thing because we're used to it; we don't change because it might mean a bit of trouble; we haven't the time to find out and test every new instrument and gadget that claims to be "the best."

So that's why lots of engineers are still plodding along quite happily without Desoutter Tools. "They don't know what they're missing," you say? Well, that's not for us to comment on.

Type M.1. Mighty Atom ¼" drill. A general purpose tool with a chuck speed of 2,500 r.p.m. weighing only 1¼ lbs., available with or without pistol grip.



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Specialists in Lightweight Pneumatic & Electric Portable Tools.

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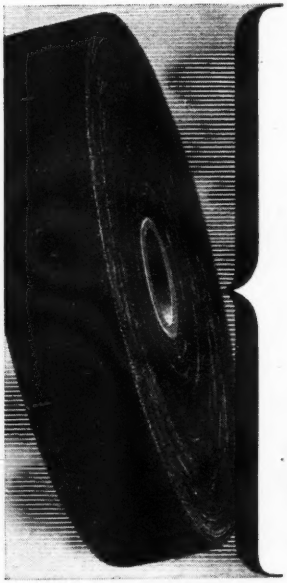

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Available in two grades—"Blackley" Adhesive Tape for the very best work where only the best will do. A really super tape. "Limpet" Adhesive Tape for the next best job where a high degree of quality is required but where price is an important consideration. One or other of these famous Adhesive Tapes will completely fill your requirements. "Blackley" or "Limpet" on every job.

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Standardised Drill Bushes *Sodium Cooled Valves*

STANDARDISATION····· *the first essential for economical production*

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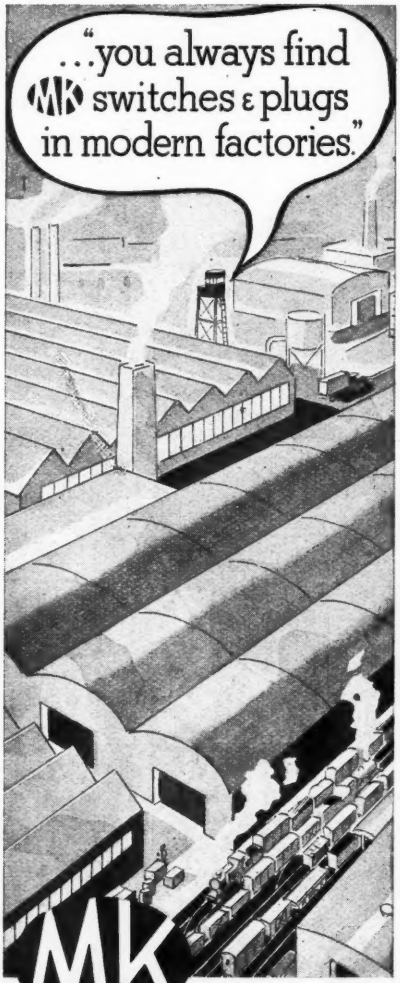

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EDMONTON, N.18

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A Tribute to the War-Workers of the Nation.

ELEXCEL LTD. LONDON & LIVERPOOL

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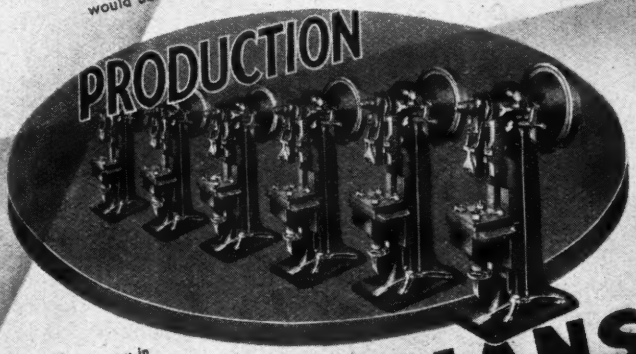
DELARON
Laminated Material

". . . so you see, production has implemented all that the designs promised." "Yes, I think we've good cause to be satisfied, especially with the way in which 'DELARON' has come up to scratch." "Well, I for one didn't doubt that the wide use we've made of it would be fully justified."

This most versatile Laminated Material has an unlimited range of applications in the manufacture of Electrical and Radio Equipment and in many branches of Mechanical Engineering. Each day sees it put to new uses which hitherto have been regarded beyond its scope."



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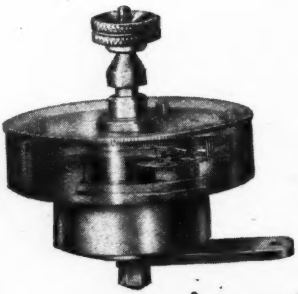

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PRECISION MANUFACTURERS SINCE 1750

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REDUCES EFFICIENCY
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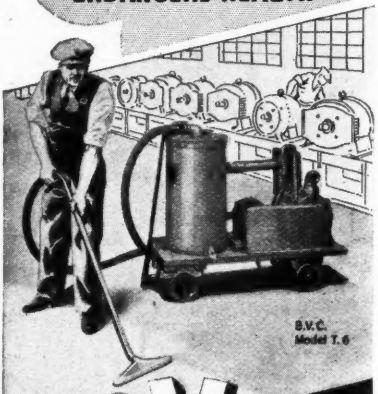

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WE MUST GET AN EVEN

QUICKER TURNROUND

Ministry of War Transport

8

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Manufacturers of
SUPERIOR SWITCH & FUSE GEAR

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See how small the Burgess Micro-Switch is compared with the hand holding it! Just think of the thousands of uses it can be put to. Operating pressure 14 ozs. Pressure differential 4 ozs. Movement differential 1/1000 inch only. Rated capacity 5 amps. at 250 volts A.C. An ounce in weight it can be installed in any position. Positive snap action with no neutral position. Switch can be operated up to 60 times a minute, at full rated capacity. Practically impossible to damage by ordinary usage. Ideal for practically all automatic switching applications.

★*Write for B.P.806/E.R. illustrating all types of switches available.*

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DIELECTRIC MATERIALS

Cable, Condenser, Coil, Transformer and Resistance impregnating, dipping, sealing, filling and finishing

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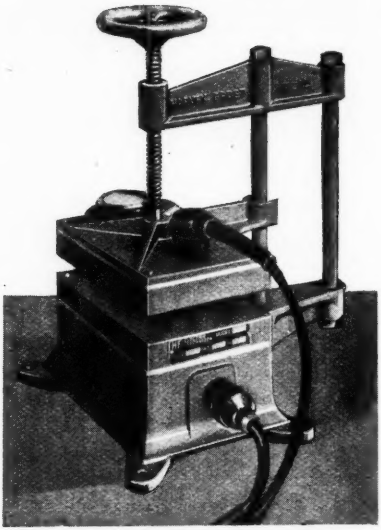

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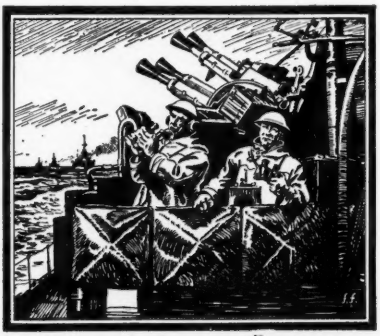

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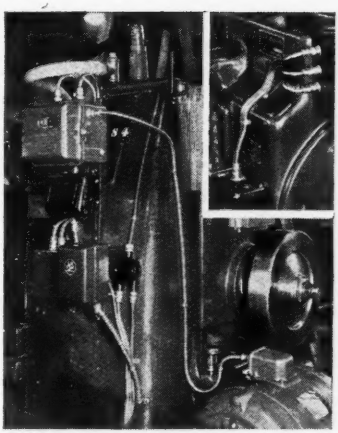

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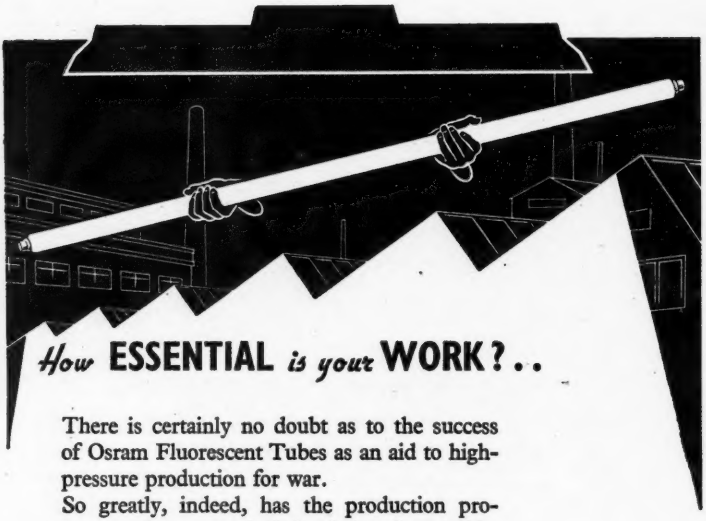

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